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The Engineering and Mining Journal

Vol. 94 DECEMBER 14, 1912 No. 24

Electric Zinc Smelting

Electric zinc smelting is still very far from being a commercial process. Out of the great amount of experimentation that has been going on, it has been learned, we think, that such smelting is metallurgically feasible, i.e., that zinc oxide may be reduced in an internally heated, electrically heated retort and spelter directly condensed therefrom. It is doubtful if anything more than that may positively be said as yet. Nobody knows yet what may be the advantages, what the disadvantages in comparison with the conventional method of zinc smelting. However, these are interesting subjects of speculation, which are indulged in freely, not always by those most competent to judge. In a recent discussion before an engineering association, the following disadvantages of the common externally heated retorts were enumerated:

1. Low thermal efficiency (maximum 6%) using a maximum of four tons of coal per ton of ore.

2. Impossibility of controlling the temperature.

3. Losses are large (from 120 lb. to 180 lb. of zinc per ton of ore).

4. Impossibility of using units containing more than 100 lb. of roasted ore.

5. Short life of the clay retort, which is attacked by mineral impurities in the ore.

6. Impossibility of treating low-grade ore.

In contrast the electric furnace is considered to present the folowing advantages:

a. High thermal efficiency, the heat being communicated directly to the ore to be roasted, and not from the outside through a fireclay wall.

b. Absolute control of temperature, resulting in a minimum loss of metal.

c. Possibility of using larger units, with longer life and reduced labor charges.

d. Possibility of treating lower grades of ore.

e. Purer and more uniform product.

f. Recovery of lead, copper, silver and gold, which the ore may contain.

g. Capital invested per ton of ore is much lower, assuming electric energy can be purchased at from $10 to $18 per hp.-year.

The supposed advantages and disadvantages above expressed may be concisely reviewed under the respective heads:

1. The maximum thermal efficiency is higher than 6%. Reduction and distillation of ordinary ore containing about 50% zinc requires about 1000 calories per metric ton. The process is done in the best practice with about one ton of coal of 8000 cal. In such cases the thermal efficiency is about 12½%.

2. Experienced furnace men control the furnace temperature within a range of about 50° C.

3. In good practice the loss may be as little as 90 lb. of zinc.

4. The Silesian retort takes a charge of about 200 lb. of ore.

5. The retorts are admittedly a weak point of the present process.

6. Ore containing only 15% zinc is, or has been, treated in Silesia.

a. The difference between development of the heat inside and outside of the retort is a matter of about 150° C. The relative thermal efficiency *in toto* is a different matter. If electrical power is derived from a steam plant, coal is burned, but in a different kind of furnace. If the steam plant possesses a thermal efficiency of 10% and the electric furnace 75%, the efficiency of the whole system is only 7½%, which is less than with some regenerative smelting furnaces in which the coal is used directly. If the power be derived from gas engines, the ultimate thermal efficiency will be higher. If the power be derived from falling water, no coal at all will be burned. In these comparisons, however, the first cost of plant is a highly important factor and any statement that fails to take it

into consideration is fallacious and misleading.

b. Unknown.

c. Probably correct as to the possibility of larger units; unknown as to the other points.

d. The validity of this assertion depends upon whether it is to be considered in the abstract or in the concrete. From the practical standpoint, the verdict at present must be rendered "unknown." Some metallurgists are working upon the line of treating mixed ores, obtaining zinc, lead and perhaps copper matte in one smelting operation. Other metallurgists consider that the first successful use of the electric furnace will be to restrict it to the highest available grade of zinc-bearing material and are directing their attention in that way.

e. Purity of product is a function of composition of ore and temperature of smelting. The electric furnace may not be expected rationally to be any more magic in this respect than the ordinary furnace.

f. Lead, copper, silver and gold are recovered in the ordinary process, but the percentage of recovery is relatively low. Increase of these percentages is perhaps the most hopeful outlook for electric smelting. Electric smelting also offers a possible opportunity of treating some kinds of ore that are especially objectionable in the conventional process.

g. This assertion is launched wholly into the domain of the unknown.

It may be added that while the retorts are a weak point of the conventional process, the electrodes are a weak point of the electric smelting. Nobody yet can say which will be the weaker.

These remarks are not intended to be an exhaustive review of the subject, but are merely some comments that may dispel certain phases of nonsense.

Return of the Principal

The directors of the Nevada Consolidated in declaring the extra dividend of a few weeks ago remarked that it was to be considered as a payment out of surplus in return of principal invested in the enterprise. It would have been interesting if they had further stated how much money had been put into the enterprise *ab initio* and how many extra-dividends would have to be paid to return it.

However, this would have been only of academic interest, because a large part of the stockholders have to reckon their amortization on what they paid for their stock in the market, not on the capital actually invested in the business, the difference representing the cream skimmed off by the wise promoters. In spite of extra dividends for capital redemption they will probably do well to continue to amortize themselves out of the regular dividends. However, it is safe to prophesy that they will not, and that in this case as in many others, a large part of the amortization will fall on the belated holders of the stock, i.e., those who own the shell after the kernel has been extracted and eaten, but don't know about it. In the case of Nevada Consolidated this is fortunately unlikely to happen for many years yet, its ore reserves being still very large.

While we are on the subject of dividends, we may appropriately remark the difference between the actual rates and the earnings forecasted by brokers' circulars in connivance with the respective managements of most of the porphyry copper companies. The circulars still talk about 6, 7 and 8c. costs of copper, but the dividends look more like 9, 10 and 11c., considering that the metal has been fetching upward of 17c. in the market for a long while past.

The Smelters' Trust

Representative Martin, of Colorado, is irrepressible. The affairs of the American Smelting & Refining Co. were investigated by a Federal grand jury, which was unable to find any violation of the Sherman law. Then Mr. Wickersham put his legal sleuths on the job; they, too, were unable to discover anything. Yet Mr. Martin is unconvinced. Evidently he sees some connection between the official whitewash brush and the Guggenheim senatorial chair. Last March he asked for a congressional investigation, hinting that it would throw some light upon the uses of the Guggenheim "barrel" and the debauchery of the electorate of Colorado. Mr. Martin flatly denied the assertion of the attorney general that competitive conditions prevail in the smelting business. Nevertheless, he was unable to make his own contentions prevail in the last session of Congress.

However, things are going to be different in the next Congress. Mr. Martin is going to have his investigation. In the meanwhile the voters of Colorado have been considering a constitutional amendment to bring the "smelter trust," as the tribunes of the "peepul" are wont to call it, under the jurisdiction of a public service commission. Incidentally this amendment, if adopted, may be troublesome to the independent smelters and millmen, it being, of course, constitutionally impossible to exempt them and single out the A. S. & R. Co. As for that company it might conceivably close its Colorado works and leave it to the Colorado ore producers to ship their ore to Salt Lake, Omaha or Chicago as they might see fit.

State control of an industry will apparently have to be complete to be effective because competition untrammeled may work in a variety of ways. Thus Salt Lake reports a very vigorous competition in the ore market among three powerful smelting interests and ore producers as enjoying very favorable rates, but the same competition is upsetting the lead market and lead ores do not realize so much in consequence thereof. A pegged price for lead and a cut-throat competition for ore would seem to be the proper remedy for this.

The canals connecting Lake Superior with the lower lakes at the Sault Ste. Marie have established a new record this year. From the opening of the season up to Dec. 1 vessels carrying a total of 71,067,000 tons of freight passed through their locks; this total being 8,704,000 tons above the previous record in 1910, and 17,620,000 tons above last year's figures. A few cargoes pass in December before the ice finally closes the passage, and a total of at least 72,000,000 tons will probably be the figure for the year.

The copper refiners' statistics for November are not especially illuminating of anything. The celerity with which the strikes at the mines in September-October were reflected in the refiners' statistics, not to speak of the fact that it was chiefly ore rather than blister copper that was cut off, is in marked contrast to the delay in showing the increased production of the early months of the year.

By the Way

In a report recently submitted to him, an engineer finds the following gem of geologico-chemical information: "The sulfate of uran being soluable has left yellow spots on the rock where the action of the water has not washed it away. Oxide of uran is worth $2 a pound."

Talk about fish stories! How many of them can equal this duck story, which comes by telegraph from Mexico: "Oil producers and refiners in the Tampico fields will lose more than $500,000 because millions of wild ducks have migrated to Mexico since the advent of cold weather, and hundreds of thousands of them have alighted in the great lakes of oil and perished there. These unnumbered flocks of dead water fowl have ruined the crude oil, which, because of the decomposed animal matter, cannot be refined."

R. B. Watson, in his excellent paper upon the unique and extraordinarily efficient metallurgical process introduced by the Nipissing company, referred to the development of this process by "Charles Butters and his assistant, G. H. Clevenger." We observed, after publication of this article, that this language might be construed as implying that Professor Clevenger had joined the staff of Mr. Butters. At the time of his collaboration in this process, Mr. Clevenger was associate professor of metallurgy in Stanford University, Calif., which is his present position.

Investigation of the alleged "smelter trust," including the Guggenheim and Green interests, will be demanded this winter by Representative Martin (Dem., Colo.). Chairman Henry, of the rules committee, says that Mr. Martin will be accorded an early and complete hearing. A mass of evidence has been accumulated by Mr. Martin, who charges that the "trust" has stifled competition by closing up smelting works. Thus reads a Washington press dispatch of last week. It will be recollected that Mr. Wickersham investigated the smelting industry a year or two ago and absolved everybody, but we do not remember that he looked into the Green interests, who may be the guilty party. We wonder who they are.

"It has been suggested and probably with some truth that the present ownership of the Lake Superior Copper and iron district by the United States is due to the reports of the early French explorers," says A. H. Meuche, in a publication of the Michigan Geological Survey. "While Doctor Franklin was in Paris, during the American Revolution, representing the interests of the colonies, he probably became acquainted with the records of the Jesuit Fathers and learned of the existence of copper along the southern shore of Lake Superior. Knowing this, would not his foresight tempt him to draw the boundary line as he did? This is particularly probable when we notice how the line curves up to take in Isle Royale."

We wonder often if we Americans obtain the same kind of mistaken ideas about foreign countries that foreigners do of us. This wonder is renewed by the following remarks in a late number of the *Australian Mining Standard*. "Everything points to the possibility of war in the very near future between the United States and Mexico. The result will probably be the annexation of the latter republic by its great neighbor, though the work cannot be accomplished without the overcoming of constitutional difficulties and without considerable disturbance of the foundations of the polity of the American Union. A considerable section of the people of the United States has long looked forward to the acquisition of the Spanish-speaking republic, especially since its great mineral resources have been developed." We recommend to our Australian contemporary a subscription to the New York *Evening Post*.

The Carnegie "old boys" assembled on Friday evening, Dec. 6, at the home of Mr. Carnegie, Ninety-first St. and Fifth Ave., New York, for the 11th annual dinner and to give themselves up once more to the exchange of stories of the old days when they knew not of such things as check books and bank accounts. The Carnegie Veteran Association gathers every year at Mr. Carnegie's home. The association elected officers before it sat down to dinner. Andrew Carnegie was returned as president; Charles M. Schwab was elected vice-president, and Charles L. Taylor is the secretary. Of course, Mr. Carnegie made a speech. Then Charles M. Schwab reviewed the battles, victories and defeats of the members. J. H. Reed, a director in the United States Steel Corporation; H. P. Bope, John McLeod, A. C. Dinkey and W. E. Corey, ex-president of the Steel Corporation, were other speakers.

Charles A. Kuenzel has patented (U. S. pat. No. 1,042,567) a method of producing a combustible gas by feeding small quantities of oil into a compressor cylinder, vaporizing the oil by compressing the mixture, and maintaining this pressure until the mixture is consumed in external burners or engines without further addition of air. How near the critical point this process might work may be realized when one remembers that the Diesel oil engine fires its charge of oil and air simply by the heat generated by compression. This reminds us of a process we saw once where a compressor was pumping sulphuretted hydrogen through a closed circuit consisting of the compressor, an air receiver, and a closed chamber. Somewhere a little air got in which evidently joined forces with the sulphuretted hydrogen and a little volatilized cylinder oil, and one day there was a tremendous explosion, during which the cylinder took on a wonderfully wide-open aspect, and neighboring movable disappeared. The inventor on arriving at the scene, looked at the remains for a minute or two and remarked: "Well, that won't happen very often, anyhow." Mr. Kuenzel's process has been saved, at least temporarily, from this denouement by extradition papers issued by the Governor of Colorado on complaint of R. C. Thompson, of Spokane, who claims that he purchased stock in Mr. Kuenzel's earlier smelting enterprise which did not fulfill the claims made for it by the inventor.

John M. Oskison, financial editor of *Collier's Weekly*, in a lecture on "Sucker Lists and Gold Bricks," has given us an adequate characterization. "The secret of being a successful seller of gold-brick securities," he said, "is to pick out something to capitalize and promote which the average person with a bank account of from $50 to $1000 knows nothing about, and then suggest, without making any definite promises, that the buyer will make at least 100% within three years. A sucker is one in whom hope is strong. He allows it to overshadow reason. He will kid himself into believing that by putting $5 into 400 sq.ft. of land only 15 miles in a straight line from some proven oil field, he is likely to own a "gusher" some day and sit in council with John D. Archbold or go down in history as a rival of John W. Gates. That is because he knows nothing about the oil business. Ask him to buy stock in a company which has capitalized the earning power of the American hen, however, and he will laugh at you. He knows too much about a hen to fall for the perfectly true statement that you can capitalize her for $15 apiece and make 10%. The best sucker lists are made up from preachers, teachers and doctors—all persons of limited income, many needs, and a highly developed sense of duty. A large family in these days of high living cost, an inelastic income, and a thrifty instinct help to make thousands of victims of the gold-brick peddlers. Ignorance of the financial side of business accounts for perhaps half the long sucker list—here are written the names of the thousands of working women, widows with payments from the life-insurance companies to invest, and those impractical souls to whom modest legacies are left. More than half a million suckers lost over $120,000,000 to the promoters who fell into the net of the post-office inspectors last year. Probably not half of the losses for the year were represented in the list of those put out of business by the postal authorities."

How Sucker Literature Is Made

In the trial of Freeman, Quincy, Hawthorne and Morton, some interesting testimony was given on Dec. 9 respecting the preparation of the bait for suckers offered through the columns of the jackal press.

Joseph D. Barker, who is employed on the *United States Investor*, was the first witness. He described an interview in 1908 with Freeman, in which arrangements were made for the publication of an article on the Temagami properties. Freeman agreed to take 900 copies of the publication containing the write-up at 12c. each. The article was published, and it was commendatory in its terms. A second story was published on Apr. 10, 1909.

"Who gave you the information in the second story?" asked Assistant United States District Attorney Dorr.

"Mr. Freeman," replied the witness, "and we were paid $20 for it."

"Did Mr. Freeman revise the proofs?"

"He did."

In this article it was declared that the development of the Temagami mines was being pushed with energy and intelligence and spoke of a "main contact vein."

Extracts from the Hawthorne literature were then read to the jury, in which it was stated that the article in the *Investor* was the result of the investigation of the *Investor's* own engineer.

"Are you an engineer, or did you represent yourself as one?" Mr. Dorr asked of the witness.

"I am not one, and I never said I was," was the reply.

"Who furnished the technical information in the article?"

"Doctor Morton."

Counsel for the defense succeeded in bringing out in cross-examination that that article was written only after the publication in question had solicited the business.

"I was neither a miner nor a geologist," said Mr. Barker, "and I relied on the statements of Mr. Freeman and Doctor Morton."

Frank S. Adams, who was employed by *The Mercantile and Financial Times*, was then called to explain an article that appeared in his newspaper.

"Some of the Hawthorne literature," he said in explanation, "drifted into the office. It looked good to me, and I told some one to fix it up. I took the proofs to Mr. Freeman and said I should like to print it. He agreed to take 1500 copies at 10c. each."

In the article appeared the statements that "the company had uncovered well defined veins" and that "not one of the 30 claims of the Temagami-Cobalt company is without mining value."

"Did the writer get his information from any of the defendants?"

"No, just from the literature," was Mr. Adams' explanation.

Henry C. Stryker, a real estate man, told how *The Cobalt News Bureau* received on its own solicitation $200 for the publication of an article for which Mr. Freeman furnished the copy. It was favorable in tone and declared that the gold deposits were so rich that the promoters did not know whether they would make more from gold or silver. On cross-examination Mr. Stryker admitted that *The Cobalt News Bureau* was published at irregular intervals and had no representative in Cobalt. The publication was produced in New York.

The jackals of the press are of a lower class than the prostitutes. They are to be found in other places than in New York.

Southern Pacific Oil Land Litigation

WASHINGTON CORRESPONDENCE

Attorney General Wickersham has made in his annual report the first comprehensive statement concerning the policy that is being pursued by the Department with reference to the question of suits against the Southern Pacific R.R. Co. for the purpose of annulling patents issued to that company. Mr. Wickersham says:

In my last report I called attention to certain proceedings against the Southern Pacific R.R. Co. to annul patents issued to that company in 1904-05, under the Act of July 27, 1866, purporting to convey some 8000 acres of land believed to be chiefly valuable for petroleum. Rapid progress has been made in the most important of these suits. The case, involving the title to 6000 acres in the Elk Hills, in the southern district of California, valued at $18,000,000, has been brought to an issue, and all of the Government's testimony in chief has been taken.

This litigation rests upon the theory that the mineral lands in question were erroneously patented by the General Land Office, of which the officials were misled by representations that the lands were nonmineral, although the patents contained no express exceptions of mineral land. In this connection other litigation concerning mineral, and particularly petroleum lands of immense value, but of different legal aspect, is soon to arise between the Government and the Southern Pacific R.R. Co. and others claiming under it. The legislation under which that company obtained its grants of public lands expressly excepted mineral lands other than iron or coal. The patents in express terms except from the premises patented all mineral lands other than iron or coal lands. Among the lands which, but for the exceptions, the patents would convey, are large areas of oil lands in California, said to be of a value exceeding $500,000,000. It is the contention of the railroad company and those claiming under it that the exceptions in the patents are void. This Department, however, and the Department of the Interior have for many months been engaged in preparing to test this question. The preparations for these suits are about completed, and the suits will be instituted at an early day.

Shannon Copper Co.

The Shannon Copper Co. reports, for the year ended Aug. 31, 1912, a production of 16,406,336 lb. of copper, 170,691 oz. of silver, and 2615 oz. of gold, from which the returns were $2,594,867. Operating expenses were $1,678,737; freight, refining and all Eastern expenses, $231,900; interest and taxes $33,199; development, $90,416; leaving a net operating profit of $560,615. In addition there were other receipts, $20,401; and profit from the Shannon-Arizona Ry. of $15,723; leaving total profits of $596,739. As the $600,000 in bonds of the Shannon-Arizona Ry. are guaranteed by the Shannon Copper Co., $130,000 worth were bought by the latter corporation during the year.

The extraction was 285,210 tons, of which 42,125 tons came from opencut work. Exploration and development work amounted to 11,031 ft. Mining expenses were about the same as before (no figures given). There were few changes in the reduction works, but all the plant has been thoroughly overhauled.

Experimenting in the use of basic instead of acid converters will be carried out as soon as a new blowing engine can be installed. Experiments in leaching the semioxidized ores are still being carried on, but without commercial result so far. However, it is believed the problem will eventually be solved.

Molybdenum in the United States

No commercial production of molybdenum is known to have been made in the United States during 1911, according to the U. S. Geological Survey report. About 60 tons of rock carrying molybdenite are said to have been mined in the Ten Mile district, Summit County, Colorado, and shipped to Denver for concentration, but the material was too poor to pay for treatment. Some further work was reported as having been done upon the Catherines Hill deposit near Cherryfield, Me., but it was developmental and experimental, and there was no commercial production. The use of molybdenum in steel making does not appear to be increasing, although magnet steels are being made which contain about 6% of Mo. Other uses are being developed, however, particularly in making small electric furnaces, for which it is said to be the best substance yet employed. Some of the tungsten filaments used in electric lamps are supported at the lower end by molybdenum wire.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Work of the Bureau of Mines

There has recently come to my desk a copy of *Bull.* 43, from the Bureau of Mines, entitled: "Comparative Fuel Values of Gasoline and Denatured Alcohol in Internal Combustion Engines." In glancing it through I find that the pamphlet covers, index and all, 243 pages, and records a bewildering array of experiments, tests, with diagrams, curves and everything necessary to give to the subject a fitting air of finality and profundity.

A somewhat closer inspection shows, however, that the results arrived at are no different from other recent investigations, particularly an exhaustive series carried out by Profs. Lucke and Woodward along practically the same lines. Moreover, the same results can be definitely predicted from the chemical analyses and thermo-chemical properties of the two substances. Prof. J. W. Richards gives in his "Metallurgical Calculations" the heats of combustion of 1.0 cu.ft. of benzene, methyl- and ethyl-alcohol gases, which are, respectively, 3869, 799 and 1544 B.t.u. Hence the idea of comparing the values of substances, which in point of calorific power stand in the ratio of 4.6:1.0: 1.9 respectively, when the ratio of cost between gasoline and denatured alcohol is about 1: 3 or 4 in favor of the former, is not very evident.

So many dreary pages devoted to answering a question that can, for most practical purposes, be answered in a few moments from the principles of thermo-chemistry ought, surely, to be considered in the light of a "settler," yet we are reminded on the concluding page of the work:

> However, because of the changing character of the gases as combustion progresses and the consequent changes in the specific heats, a study of these features (efficiency of denatured alcohol at different degrees of compression) will be surrounded with many difficulties. Nevertheless, future work along this line could be profitably spent in analysis of exhaust gases with a view to learning something of their specific heats, in the hope that knowledge thus obtained may enable investigators to attack the problem in the future with greater intelligence and knowledge of the principles involved.

So it seems, after all, that after traversing a long and misty path we are brought back once more to the point from which we started; and evidently there is a chance for another attack, and probably a good many more, depending upon the amount of funds available.

Now, if a humble citizen may be so bold as to ask, what is the use of the Bureau of Mines devoting its time and money to the investigation of a subject which concerns the industries connected with the production of denatured alcohol and not mining? And why, after the Department of Agriculture, in which such investigations would properly belong, had completed and published a conclusive report, should an almost exactly similar investigation be undertaken by the bureau? Is it because the bureau has on its payroll a numerous bunch of retainers, and in order to keep them busy something must be found for them to do? Judging from the number and character of the bulletins issued from the bureau since its establishment the object too often appears to have been to "get busy" with something and then feed it to the press.

Granting, of course, that a new bureau, in order to meet all the claims made by its promoters (and the bureau itself, once established) as to the utter lack of scientific management, lack of knowledge, criminal extravagance, and general depravity and ignorance hitherto prevailing in the mining industry, which said bureau is to remedy, is rather "up against it," and has a difficult position to maintain in these days; yet it would seem that with the exercise of a little knowledge on the part of those directing the work, more pertinent topics might be selected.

ENGINEER.

Knoxville, Tenn., Dec. 3, 1912.

Food Supplies for Miners

The following list was compiled by a Canadian Pacific R.R. engineer from several years' store sheets, and refers to construction camps. The bacon and flour may be a little high, but much depends upon the work being done, working temperature and cook's ability. If tinned meat be taken, the bacon can be reduced.

DAILY RATION

	lb.		lb.
Flour	1.25	Salt	0.10
Bacon and ham	1.40	Mustard and pepper	0.01
Beans	0.47	Currants	0.03
Dried fruit	0.20	Raisins	0.01
Sugar	0.40	Oatmeal	0.15
Tea	0.04	Rice	0.05
Coffee	0.08	Tomatoes or vegetables	0.04
Baking powder	0.06	Syrup	0.03

Beside the supplies in the list, a little lard was used in the cooking, for which no allowance is made. The total of the above ration is 4.32 lb. Other supplies on a *per diem* basis were: Soap, 0.05 lb.; candles, 0.01 pound.

A. H. BROMLEY.

Mexico, D. F., Nov. 25, 1912.

Underground Efficiency

Much has been said and written about efficiency of workmen in the different departments of the mill, smeltery, shop, and various other branches. The efficiency of labor in the concentrating and cyaniding mill and smeltery has gone far ahead of that in the mine. F. W. Taylor's paper read before the American Society of Mechanical Engineers excites the greatest respect for the amount of time he has spent in systematizing the work in machine shops and industrial establishments. On the other hand, too little attention has been paid to the results obtained in underground work, and it now seems high time that more interest be awakened in studying the problem of raising the efficiency of the usual underground labor which enters to such a large extent in the cost of producing ore.

This does not apply at all places, of course, but it will be found to be singularly true in the majority of cases. The Utah Copper Co. and Nevada Consolidated, for instance, have systematized their operations of ore extraction by steam-shovel work to such a point that any further reduction of costs of even a few cents per ton can now be reached only after a great amount of outlay in capital and thought. Costs at the Douglas Island, Alaska, group of mines are so low that further reduction seems almost impossible. However, such statements can be made in regard to but few mines.

In extenuation of this fact it can be said that the men working in a mine are scattered over several thousand feet or even sometimes miles of poorly lighted workings, rendering supervision and inspection of their work a difficult matter; also, that mines are made profitable by being exhausted and hence at the close of operations the work of perfecting an organization and systematizing the work is largely lost. The last is not the case with an industrial enterprise where it is the intention steadily to improve and increase the value of an established business. These facts may deter many a man from taking the trouble that he otherwise would if his mine were to be a permanent institution. Yet, second thought

should point out the decadence of a mine as a greater cause for increasing the efficiency to the highest possible point at the earliest moment, since there is no opportunity of retrieving later the time and money lost in producing the ore that has been extracted from year to year at a higher per ton figure than necessary.

From this the inference should not be drawn that a perfect organization can be acquired in a month or even a year; consequently the maximum efficiency cannot be obtained in a limited space of time. It has been my observation in visiting a good many mines, that where fair results are being obtained there is a tendency to "let well enough alone"; and yet the only way that the maximum efficiency can be obtained, is by keeping continually "at it" month after month, and year after year. As in other lines of work, radical changes are often dangerous, frequently resulting in serious accidents, dissatisfaction among the employees, or even strikes, and thereby results in a reduced efficiency. Hence, changes should be brought about gradually, the men being shown by increased pay for increased effort that it is to their interest as well as to that of the company to do more and better work. There is altogether too little attention paid by the manager and superintendent to the actual time required in performing the various underground operations. A superintendent is not, of course, expected to spend his time in actually timing the work of the men, but he should have men appointed to do the work of timing the various operations and to tabulate results afterward, putting them in a well arranged and comprehensive form which can be readily grasped.

The time lost in underground work would prove a revelation to the superintendent were more of this done. As a rule, too little attention is given to the pointing of holes. This should be studied for the purpose of determining how to break the maximum tonnage with the minimum footage of holes drilled, and should be based on careful, systematic study and not on guesswork. Careful attention should be paid to the sharpening and tempering of drill steel, so that the miner can get the maximum footage of holes with the minimum expenditure of effort. The quality and quantity of explosives, caps and fuse consumed should be given careful consideration in order to get the maximum benefit. Many a superintendent eases his conscience with the thought that the large consumption of dynamite is no concern of his, when the work is done on contract, since the contractor has to pay for the supplies. A moment's consideration should show him that the contractor must add the cost of supplies to the price of his labor before bidding for the work; and hence the company finally has to bear the expense.

Proper shovels should be provided the muckers, and the easiest way of handling the work should be worked out. Grades on tracks should be properly laid out and easy-running cars be procured in order to obtain the maximum efficiency from the carmen. Timbering from its nature should have the most careful supervision in order to obtain the best efficiency in the workman and maximum economy in the use of timber. In short, only the most careful thought and calculation of the various elements that make up the underground work will result in the desired efficiency. And finally, by never becoming discouraged and pushing ahead continually, results will be accomplished that at first seemed impossible. From time to time, valuable cost data are published in the technical magazines, and there should be more of it; and these cost data should be accompanied so far as possible with a statement of the conditions under which these costs were obtained. If this were done it would be of invaluable assistance to men in charge of mining properties, in helping them to solve their own peculiar problems.

S. F. SHAW.

Charcas, S. L. P., Nov. 20, 1912.

Settling of Slime

I wish to thank C. H. Jakin for his frank criticism in the JOURNAL of Nov. 12, 1912. The results of the two tests given in this criticism in no wise disprove the principle set forth in my article; on the contrary, Mr. Jakin's tests tend to prove the accuracy of my experiments and deductions. Let us examine the results of Mr. Jakin's tests:

In Test 1, it required seven hours to settle a pulp to a desired thickness in a tank 12 ft. deep, and 45 min. to settle to the same thickness in a 5-gal. oil can, which is 1.25 ft. deep. In Test 2, it required 17 hr. to settle a pulp to a desired thickness in a tank 10 ft. deep, and two hours to settle to the same thickness in an oil can (1.25 ft. deep).

An inspection of the above results will show that these two tests closely conform to the following principle of settling: The time required to settle a dilute slime to a required degree of thickness is proportional to the depth of the settling column. Mr. Jakin has noticed this fact and concluded that the rate, or efficiency, of settling is greater in the shallow than in the deep tanks. He has failed to consider, however, that the amount of pulp settled is also proportional to the depth of the settling column.

Imagine two tanks of the same diameter, one 10 ft. deep and the other 1.25 ft. deep (the depth of an oil can). If the two tanks are filled with the same kind of pulp, we would expect that the deep tank would require eight times as long to settle to a desired thickness as would be required in a shallow tank. This fact is brought out by both my own and Mr. Jakin's tests. But it must be remembered that eight times as much pulp is settled in the deep tank as is settled in the more shallow one. It, therefore, follows that the settling rate or efficiency must be the same in each case, and is independent of depth of vessel.

EFFECT OF SETTLING RATE

Test No.	H Depth Column	T Time Min.	P_1 Original % Moisture	P_2 Final % Moisture	L(from formula) Depth in feet of liquid formed	$\frac{L}{T}$ Settling rate Depth liquid formed per minute
1	12.00	420	59	46	3.88	0.0092
	1.25	45	59	46	0.40	0.0089
2	10.00	1020	90	81	5.05	0.0050
	1.25	120	90	81	0.63	0.0052

It will be remembered that one of the most important deductions made from my tests was that, in settling a dilute slime to a desired degree of thickness, the settling rate (or depth of clear liquid formed per minute) is independent of the depth of the settling column.

In order to show that Mr. Jakin's tests conform to this principle, I have calculated the depth of clear liquid formed in each of his tests by the following formula:

$$L = H - \frac{H\,(100 - P_1)(P_2 + 61)}{(100 - P_2)(P_1 + 61)}$$

In which,

L = Depth in feet of clear liquid formed;

H = Depth in feet of settling column;

P_1 = Original per cent. moisture;

P_2 = Final per cent. moisture.

The accompanying table gives the results of my calculations on Mr. Jakin's tests and show that in his tests, as in my own, the settling rate is practically independent of the depth of the settling column.

El Tigre, Sonora. R. T. MISHLER.

Nov. 28, 1912.

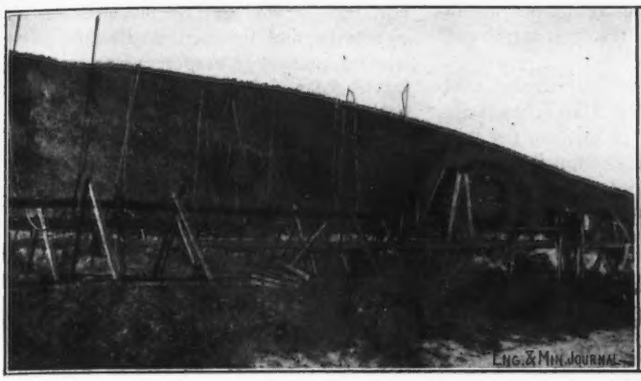
Leaching of Copper Ores

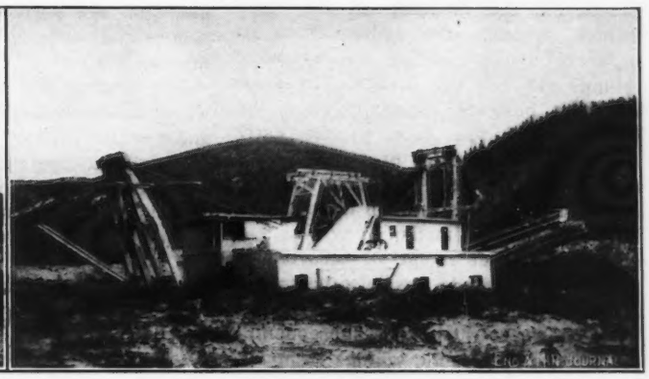
The report of the Shannon Copper Co. again makes reference to experiments in leaching the semi-oxidized ores. The other big copper interests are likewise experimenting, but saying little. Braden was understood to have solved the problem, but is now also working on flotation, I hear. Will anything ever be known of the schemes that failed, or will these fruitless efforts remain as mysterious as the many-years-old success of the Arizona Copper Co. in the same field?

A. A. NASON.

New York, Dec. 9, 1912.

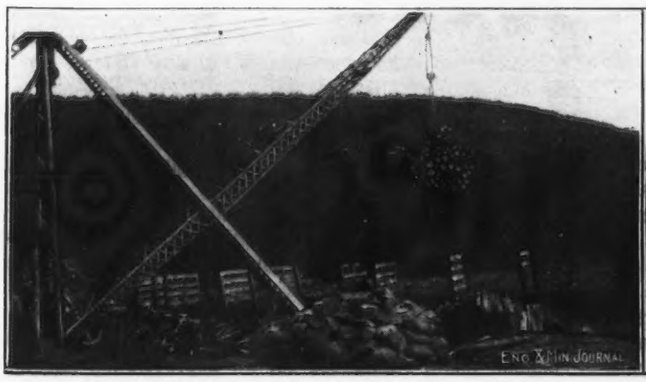
Photographs from the Field





THAWING FROZEN GRAVEL WITH STEAM POINTS PREVIOUS TO DREDGING

GENERAL VIEW OF DREDGING OPERATIONS ON BONANZA CREEK, YUKON TERRITORY



UNLOADING WOOD AT A THAWING PLANT

DREDGED CREEK, SHOWING WATERWAY LEFT BETWEEN BANKS

Dredging on Bonanza Creek, Yukon Territory

By Henry Mace Payne*

On Bonanza Creek, Yukon Territory, both dredging and hydraulicking operations are being carried on. Whenever practicable the dredging of the creek bottom precedes the hydraulicking in order to avoid handling the hydraulic tailings through the dredge. In some instances, however, especially where the hydraulicking was done in the early days and the recovery of gold was not thorough, it has been profitable to wash these tailings again through the dredges. Likewise, modern methods, by which a much higher percentage of recovery is possible, have made possible the profitable dredging of claims thought worthless 10 years ago and subsequently covered with hydraulic tailings from the hills above.

At the plants which generate steam for thawing the frozen gravel, wood is exclusively used for fuel at present, although fuel oil and the local lignites have been tried and the subject of producer gas has been investigated. As a result the mountain sides have been denuded of all timber for many miles within the vicinity of Dawson. The timber now used is rafted from the headwaters of the Klondyke, and from Stewart and the upper Yukon Rivers. The large logs are used for cribbing and the smaller ones for fuel.

The logs are cut into cordwood length at the river bank, and loaded in rope slings on flat cars of the Klondyke Mines R.R. Upon arrival at the thawing plant the cars are unloaded by a portable electric crane, the wood in any pile being sufficient to thaw all the area within a radius of 1500 ft. Another pile is then started about 3000 ft. beyond, and by the time the thawing plant is moved forward, a large amount of wood has accumulated in readiness.

The Yukon River being exceedingly swift and full of rapids, the wood contractors suffer heavy losses from rafts which break away, and, drifting below Dawson become a total loss, as no market is then available for many hundreds of miles; the cost of towing them up the river again would be prohibitive.

The gold-bearing gravel and overlying muck being frozen, it is first thawed by driving steam points down to bedrock. These points are spaced at intervals of from eight to 10 ft., and driven from five to 30 ft. down, depending on the depth of the frozen overburden.

Steam is generated by portable boilers and transmitted through a main 3-in. pipe to 2-in. headers and 1½-in. goosenecks, with which the points are connected by rubber hose. These points are in varying lengths, like drill sets, and are advanced as thawing takes place by men standing on step ladders and wielding sledge hammers.

It is aimed to thaw several weeks in advance of the dredges in order that the ground may "sweat," and thus thoroughly disintegrate the frozen mass, the black muck on the surface acting as an insulator and retaining the heat introduced through the points.

The dredges are of the regular type, with buckets averaging 7 cu.ft. capacity, and a chain speed of 18 buckets per minute, giving a theoretical capacity of 6720 cu.yd. per 24 hr. Dredges with 16-cu.ft. buckets have been completed recently on Klondyke River and will be put in operation next season.

*Mining engineer, Stephen T. Williams & Staff, 346 Broadway, New York.

Belgian 1911 Metal Production

In 1911 there were 13 zinc smelters and 11 zinc rolling mills working in Belgium, employing a total of 8732 workmen. These works consumed all of the Belgium mineral production and 470,290 tons of foreign ore. There were 958,370 tons of coal consumed by these works. The production of spelter was 198,238 tons, of which 49,635 tons were rolled.

There were six lead works operating in Belgium employing 1806 workers. These treated, in 1911, 69,440 metric tons of ore, coming almost exclusively from foreign countries; 103,870 tons of plumbiferous and argentiferous byproducts and 51,970 metric tons of work lead. Not including the work lead from foreign countries which was treated in Belgium the refined lead production was 44,308 metric tons. There were 252,720 kg. of gold and silver produced, and 310 tons of copper matte as a byproduct.

There were 17 works operating iron blast furnaces. There were 46 furnaces in blast which consumed 2,186,820 tons of coke and 5,442,550 metric tons of ore. Of this ore 54,470 tons were domestic. Pig-iron production amounted to 2,046,280 metric tons. Of this 1,882,960 tons were used for steel making.

It appears from the figures of stock on hand at the beginning and end of 1911, and considering the imports and exports of that year, that the true domestic consumption of Belgium in 1911 was 2,727,878 tons of pig.

The only mercury mines now being exploited in Russia are those of Auerbach & Co. in the Ekaterinoslaff government. They are being transferred to Belgians, says the *Mining Journal*, Oct. 26, 1912. These mines were abandoned of recent years on account of financial troubles. The cinnabar there appears as a crystalline mass in sandstone, and partly in quartzites underlying the sandstone. Besides cinnabar, stibute is common there, also sulphur in stelliform accumulations.

American Mining Congress

Special Correspondence

The annual meeting of the American Mining Congress began at Spokane, Wash., Nov. 25, continuing until Nov. 29. At the opening meeting addresses of welcome were made by Mayor W. J. Hindley, R. Insinger of the chamber of commerce and Graham B. Dennis. The leading address in response was made by David Ross, labor commissioner of Illinois. Others who spoke were Glenville A. Collins, representing the Peruvian government, E. Jacobs of British Columbia, George E. Baldwin of Valdez, Alaska, Paul Clagstone of Clagstone, Idaho; W. B. Shackleford, of Joplin, Mo., and R. L. Dougherty of Leads, S. D. President S. A. Taylor also made an address.

In the evening President Taylor delivered his annual address, in which he reviewed in detail the work of the sessions that have led up to this, the 15th congress, and named some of the things that lie within the scope of future activity. These included conservation in the broader sense and the protection of investors in mining property. The diversity of mining law in different states, the federal control of mineral and water-power sites, and the subject of workmen's compensation were all taken up during the address. In concluding, President Taylor declared that the future of the organization was sure, and took up some details for strengthening its machinery during the course of the coming year.

Other sessions during the week were devoted to reports of committees, the presentation and discussion of resolutions.

New Officers

The officers elected for the ensuing year were: President, D. W. Brunton, Denver. Vice-presidents, Hennen Jennings, Washington; E. A. Montgomery, Los Angeles, and Carl Scholtz, Chicago. Secretary, J. F. Callbreath, Denver.

At the meeting of the incorporated body the following directors were chosen: For three years, Harry L. Day, Wallace, Idaho; George H. Dern, Salt Lake City, Utah; W. G. Conrad, Helena, Montana; D. W. Brunton, Denver, Colo. For one year, W. B. Shackleford, Joplin, Missouri.

The following is a summary of the resolutions passed at the meeting:

Nos. 1 and 2—Urging the President-elect of the United States to select as secretary of the interior a resident in the Public Lands states, acquainted with public-land laws and who by actual experience is familiar with western conditions.

No. 3—That an appeal be made to Congress for an appropriation adequate for immediate compilation and publica-

tion by the Census Bureau of the data now on hand relating to mines and quarries.

No. 4—That in all cases where active development is in progress, unproductive mining property may not be burdened with taxation. Asking that every inducement be offered to stimulate effort that will create property able to bear the burden of taxation. Also, that a committee on mine taxation be appointed, and asked to report to the next session of this congress.

No. 5—Advocating that some measure of relief be afforded miners and prospectors by providing for the construction of roads in isolated mining districts located within forest reserves, and that the Forest Service be required to assist in constructing and maintaining such roads.

No. 7—That as a number of the states are now considering the advisability of placing upon their statute books laws governing and controlling the sale of stocks and bonds, a committee be appointed to gather information on this subject and ascertain what laws are now on the statute books of various states, and submit a report thereon to the next meeting of this congress, or to the board of directors for appropriate action.

No. 9—Recommending to Congress the enactment of a law authorizing claimants to coal lands in Alaska located prior to Nov. 12, 1906, to maintain actions in the courts of Alaska against the United States, to determine the validity of their respective claims, etc.

No. 10—Asking that the Mt. Olympus National Monument (a reserve of more than 600,000 acres within the Olympic National Forest, State of Washington) be abolished and that area be restored to the Olympic Forest, which will amply protect the scenic value of the region without prohibiting prospecting and mining.

No. 11—Asking that Congress legislate to secure similar charges for assaying gold in the United States assay offices of the West and on the Pacific Coast, as at the United States assay office, New York.

No. 12—Favoring legislation conferring jurisdiction upon the proper United States courts to entertain suits and determine the law of fact *de novo* and render final decision in all cases involving the claim or right to possession, title, etc., to any non-mineral or mineral lands under mining or other public-land laws, under certain stated conditions.

No. 14—That laws be enacted extending the principal of eminent domain to aërial trams, electric lines, and to pipe lines and other proper utilities.

No. 15—That Congress be commended for authorizing the beginning of studies of problems of metal mines, such as exist in the West—in particular mining accidents; also the treatment of low-grade ores and tailings not at present commercially valuable for lack of suitable means of treatment.

No. 16—Superseded by a later resolution.

No. 17—Again urging the passing of legislation now pending, and providing for Federal assistance to state mining schools.

No. 18—Authorizing the president of the American Mining Congress to appoint a committee on Alaskan affairs (1) to give publicity to deliberations of the congress on Alaskan questions; (2) to urge the United States Congress to grant prompt relief as proposed; and to work to secure the passage of laws that will permit development of Alaska's varied resources; also, to work to secure the construction of railways.

No. 19—Urging enactment of state laws against mills, smelteries, etc., disguising or destroying identity of any lot of ore before its value shall have been definitely agreed upon between the buyer and the seller.

No. 20—Advocating thorough revision of Federal mining law, and to secure a commission to study and report on a form of revision.

No. 21—Advocating the retention of the present tariff duties on lead and zinc ores, and pledging opposition of the American Mining Congress to any reduction.

No. 22—In connection with compensation to working men injured in industry, reaffirming faith in the justice of the position that each industry should carry its own burdens, resulting from accidents incident to it, and urging the passage of laws embodying this principle.

No. 23—Favoring the construction of two trunk lines of railway from the Pacific coast of Alaska to the great navigable water systems of the interior; either by government aid, or by the government itself. Also, the repeal of the annual license tax of $100 per mile and the warehouse tax in Alaska.

No. 24—Recommending legislatures of the various states containing large areas of Federal reservations to endeavor to secure, by their representatives in Congress, appropriations necessary to cooperate with all main and trunk line wagon roads, etc. Congress to be requested to provide for the construction of roads through Federal reserves.

Resolutions Nos. 25 and 26 dealt with matters connected with financing the American Mining Congress, and No. 27 was an expression of appreciation of help and entertainment provided by local bodies and all others.

The congress adjourned at the close of the session of Friday afternoon, Nov. 29. Then two days were occupied in visiting Cœur d'Alene city, Kellogg, Wallace, Burke and Mullan, Idaho, and at each place generous entertainment was provided for the visitors. The chief mines and mills seen were those of the Bunker Hill & Sullivan, the Hecla, and the Morning companies. The return to Spokane was made on the night of Dec. 1, and the visitors then dispersed.

Dominion Nickel-Copper Co., Sudbury

SPECIAL CORRESPONDENCE

The Dominion Nickel-Copper Co., which was formed about six years ago, to acquire properties in the Sudbury district, principally on the North Range, has been considering the building of a smelting plant. If built, the smeltery will probably be erected at the site of the old Murray plant, on the property recently purchased from the Vivian estate, of Swansea, Wales, by the Dominion company.

An examination of the mine has recently been made for the company by a staff of engineers, under the direction of Benjamin B. Lawrence, of New York. The company has spent nearly $250,000 in drilling, chiefly on the North Range holdings and on property in Falconbridge township. The principal properties on the North Range are around Nickel Lake, in the township of Bowell, and Joe Lake, in the township of Wisner.

At the Whistle mine, at the far northeastern corner of the district, the company has done extensive work and has the property ready for production. A town called Nickelton has been established at this mine. The company has recently purchased the Murray mine and the properties of the Lake Superior Corporation—the Gertrude, Elsie and the Victor. It has also taken an option on the Kirkwood. All of these new acquisitions are on the South Range except the Victor. Drilling is now in progress and good results are reported, particularly on the Murray. The company now has the largest holding of ore reserves in the Sudbury nickel district, except the Canadian Copper Co., the local organization of the International Nickel Co. The Mond company, a British corporation, also has extensive ore reserves in the district. The Dominion company is financed and controlled by J. R. Booth, of Ottawa, and M. J. O'Brien, of Montreal. The general manager is J. A. Holmes and the business manager J. N. Glidden. The company's headquarters are at Sudbury.

Bureau of Mines Budget

The probable expenses of the Bureau of Mines for the fiscal year June 30, 1913, to June 30, 1914, are estimated as follows: General expenses, $70,240; investigating mine accidents, $347,900; fuel investigations, $135,000; investigations into the treatment of ores and other mineral substances, $250,000; inspecting mines in Alaska, $6500; books and publications, $2500; toward erection of a

laboratory at Pittsburgh, $115,000; collection of statistics, $25,000; purchase or lease of land for headquarters of mine-safety cars, $2000; total, $954,140.

The increases asked for include $4140 for general expenses, $27,900 for investigating mine accidents, $200,000 for investigations into the treatment of ores and other mineral substances, $1000 for the purchase of books and other publications, $115,000 toward a new fireproof laboratory, and $25,000 for the collection of statistics concerning accidents in the mining industry and other interests.

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co., operating at Ray and Hayden, Ariz., for the third quarter of 1912, shows a production of 9,295,818 lb., made up as follows: July, 3,105,165 lb.; August, 3,055,490; September, 3,135,163 lb.; derived from 429,411 tons of 1.6148% ore of which 24% was produced by development work.

The average daily tonnage for the quarter was 4667 tons, but an average of 5000 tons was maintained during September. The extraction for the quarter was 67.026%, which is attributed to the fact that much of the tonnage is still derived from the upper levels of the mine and therefore contains considerable quantities of oxidized ore, and to the dropping of the grade of the ore by 0.1%, as compared with the previous quarter, in which the extraction was 69.37 per cent.

The total production of concentrates for the quarter was 25,926 tons, containing an average of 17.93% copper, and the ratio of concentration was 16.56:1. The average cost per pound of net copper produced during the quarter, after allowing for smeltery deductions and after crediting the earnings of the Ray & Gila Valley R.R. against operating costs, is given as 10.027c. as compared to 9.954c. for the preceding quarter. This cost includes all operating and general charges, as well as 12½c. per ton, or approximately 0.6c. per lb. on the quarter's production for the extinguishment of mine development expenses.

The direct operating profits for the quarter were $640,748; miscellaneous income, rent, etc., $9965, and total net profits for the quarter, $650,713. The earnings are computed on the basis of 17.13c. per lb. for copper, or approximately 0.5c. per lb. less than was actually received for the copper sold during the period. This has been done in order to bring the inventory price of copper in transit down to 12½c. per lb. The entire stock of copper in transit or unsold is now said to be carried at that figure. It is stated that at the close of the quarter no copper due for delivery from the refineries remained unsold.

In this quarter the sixth section of the Hayden plant was put into operation, and the seventh section is well toward completion, leaving only one to finish, and this last is also partly completed, all the material and apparatus required for it being on the ground. The power plant and all other accessories are completed with the exception of unimportant details, and on the whole the expenditure necessary to finish the entire plant will be comparatively small.

Sinking of the No. 3 shaft on the original Ray Central territory has progressed more slowly than was expected, due to this shaft being deeper than any workings in the vicinity and consequently draining the entire surrounding territory, giving more water to handle than was anticipated. The shaft should be finished in November, and ore production from the high-grade body in the Ray Central territory started in December, or at all events not later than Jan. 1, 1913. Development work amounted to 37,715 ft. during the quarter, bringing the total workings in the mine at the end of September up to 264,000 ft., or about 50 miles.

Allis-Chalmers Reorganization

The Allis-Chalmers reorganization committee reports that securities deposited under its plan now total as follows:

	Deposited	Outstanding	Per cent.
Bonds	$10,458,000	$11,148,000	93.8
Preferred stock	14,146,500	16,050,000	88.1
Common stock	17,215,600	19,820,000	86.9

The United States District Court of Milwaukee has entered final decree of sale in the suit to foreclose the first mortgage of the company, and sale will take place on Feb. 3, 1913. (Cf. ENG. AND MIN. JOURN., p. 726, Oct. 19, 1912). This sale through the reorganization committee representing the bondholders, is a formality necessary to make the new organization plan, with its new stock and bond allotments, effective.

Iron Blast Furnace Capacity

According to the figures collected by the American Iron & Steel Association, there were, on June 30 last, blast furnaces in existence having a total nominal yearly capacity of 42,950,000 tons of pig iron. Between June 30 and Nov. 30, one new furnace, of 20,000 tons capacity, went into blast; and four, of 86,000 tons capacity, were definitely abandoned and wholly or partly dismantled, leaving the capacity on Nov. 30 at 42,893,060 tons yearly.

Of these furnaces, however, there are a number having a total yearly capacity of 1,766,000 tons, which have been long idle. Most of these, by reason of antiquated construction and equipment, or unsuitable location, will probably never go into blast again, and they should be deducted from the total iron-making capacity; leaving it at 41,127,000 tons yearly. The condition of these furnaces on Nov. 30, expressed in terms of their total yearly capacity, was: In blast, 35,068,000 tons; out of blast, but expecting to resume within a few months, 1,986,000; out of blast, with no date for resumption fixed, 3,673,000 tons. All of the last named class have made iron since 1898, and may be considered as capable of entering the active list. The production of pig iron reported on Nov. 30 was at the rate of about 31,800,000 tons yearly.

Southern Pacific Geologist not in Government Employ

Complaints have been received from Barstow, Calif., that a geologist in the employ of the Southern Pacific R.R. is using in that vicinity cards representing him as connected with the U. S. Geological Survey. The Director of the Survey has secured further evidence and is convinced that there is substantial basis for the complaints and therefore informs all concerned that Leon J. Pepperberg resigned from the U. S. Geological Survey, Mar. 23, 1910, and since that time he has not been employed by the Survey nor has he been authorized to collect data for its use or to represent it in any capacity. Mr. Pepperberg's use of a business card reading "Mining Geologist, U. S. Geological Survey, Washington, D. C.," is wholly unwarranted and his title prior to his resignation was not even geologist, his grade being "Junior Geologist," and neither his title nor his work was in any sense that of Mining Geologist. Such self-designation was not truthful prior to 1910 and since then is absolutely false.

Director Smith adds that the public can be assured that anyone in the employ of the Southern Pacific or any other corporation in the United States, who represents himself as a member of the U. S. Geological Survey is an imposter, as the Survey policy based upon a federal statute specifically prohibits such double employment.

Ferrochrome Syndicate

The international ferrochrome syndicate, which, though only in course of formation, has played a most prominent part from the beginning of this year in regulating prices, has now been definitely constituted, with a head office in Paris, says the *Mining Journal*, Nov. 2, 1912. It embraces all important European producers, but it has not been considered necessary to include the Americans, the reason being that the whole of the American output is absorbed by domestic consumers, while, on the other hand, the prohibitive tariff prevents imports from Europe.

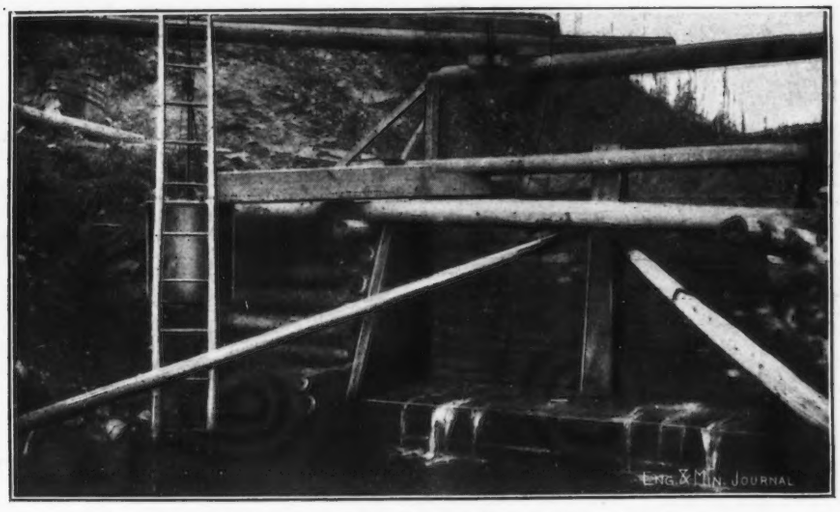
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

An Automatic Splash Dam

By Henry Mace Payne*

This ingenious arrangement, while having been used in California in the past, is nevertheless sufficiently interesting to warrant passing attention. The accompanying photograph was taken on Dominion Creek, Yukon Territory, where the mining company is ground-sluicing the top muck away from the underlying gold-bearing gravels. The material so eroded must be carried many miles down the creek and into Indian River, in order to avoid building up flats in the stream and thus nullifying the process. This requires a larger volume of water and a swifter current than could normally be obtained.



Automatic Splash Gate, Dominion Creek, Yukon Territory

The gate is built in vertical slides, and from its top a small wire rope passes over pulleys on the headframe and down to a suspended iron tank, formerly used as a container for oil. Inset about an inch in the top of the gate, and leading to the iron tank, is a sluice box about 12 in. wide and deep.

When the water has reached the level of the sluice box, and just before overflowing the dam, it flows into the iron tank, which when full, weighs more than the weight of, and pressure on, the gate. As a result the tank settles, raising the gate and allowing the pond to empty.

In the meantime the water in the tank has been slowly escaping through a small hole punched in the bottom, so that by the time the pond has been emptied, the tank has also emptied and the weight of the gate being greater than that of the empty tank, the tank rises and the gate falls back into position. By this simple arrangement advantage is taken of the entire stream flow, which would otherwise be too sluggish to accomplish results of any value.

*Mining engineer, Stephen T. Williams & Staff, 346 Broadway, New York.

Planetable Surveying

The planetable is a most useful instrument to those engaged in topographic and geologic work in more or less isolated and rugged mining districts; but as yet it is seldom used by mining engineers. The reasons for this are twofold; the technical schools do not teach the use of the planetable in such a way that the student can grasp its full possibilities, and there is an entirely reasonable hesitancy in undertaking any new methods in the midst of the press of work with which one is usually surrounded, says D. F. Higgins (*Economic Geology,* Aug., 1912).

In a new mining camp the geologist is confronted with the problem of working out the detailed geology of a considerable area in a limited length of time. In a new and rough country traversing is tedious and difficult, and even with the stadia it is inaccurate without special precautions. In the summer of 1911 such a piece of work was undertaken with the planetable as outlined below.

The problem was to map on a scale of 1500 ft. to one inch an area about one mile wide by five miles long. The maximum relief on this five square miles was between 2300 and 2400 ft.; and the area extended over a pass about 2000 ft. above each of its extremities. The principal geologic feature of the area was an irregular contact between an intrusive basic granite and a sedimentary series. The country was fairly treeless and fairly easy upon which to move. In doing this geologic work a Bumsted, or "baby," planetable tripod was used. A light 18x24-in. drawing board was substituted for the usual 15x15-in. top. For sighting, a light and cheap Japanese telescopic alidade with stadia hairs, and vertical circle reading to 3′ was used. The straight edge on the alidade was 11 in. long. The weight of this outfit was 12½ lb. In addition to the planetable and alidade were carried the usual impedimenta—hand-level, hammer, hand compass and clinometer, collecting bag, etc.; and an 8-in. peep-sight alidade carried in the hip pocket was useful for secondary sights.

On the first day the south base, 1475 ft., was measured with a 500-ft. steel tape, and a reconnaissance triangulation net was laid out. This was done by "occupying" the ends of the base and likely stations, expanding the base roughly. Bearings were taken with a Brunton compass, and in the field they were plotted to a small scale on a notebook page with a protractor. In this way the area was roughly laid out for control, although all the stations used later did not have to be visited. The next day freshly hewn 3-in. square stakes were placed on all the points not already sufficiently marked by prominent rocks. Two assistants were used on the second day. On the third day the triangulation was expanded on the planetable and carried northward. Late in the afternoon of the fourth day the net was closed on the stations *O, P* and *Q* which had been located from the north base, 388 ft., by transit observations. In this work especial care was taken to center the planetable over the stations and to extend all lines of sight on the paper. Stations *A, B, D, E, F, H, I, J, K, L, N, O* and *Q* were occupied. The sides of the triangle *OPQ* were computed from the transit observations and compared with the distances

as scaled to one-third of one-fiftieth of an inch, or to the nearest 10 ft., from the graphic work as developed from the south base. The results were:

Line	Computed Distances, Feet	Scaled Distances, Feet
OP	3254.2	3250
OQ	2224.2	2220
PQ	2766.9	2750

Thus the expense and the time necessary for an instrumental survey were obviated, and the accuracy of the work was well within that demanded by the geologic mapping. Vertical control was established throughout and numerous secondary points located.

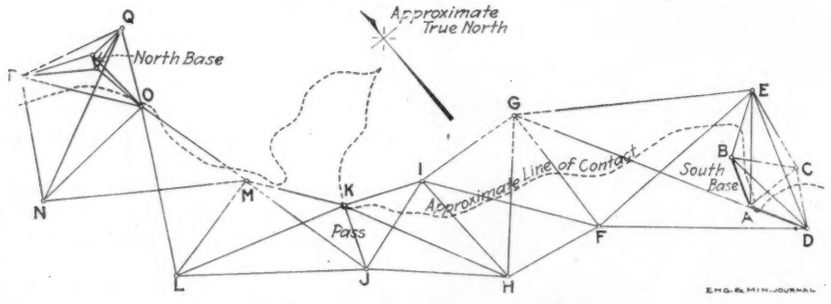
The geologic mapping and the topography in 50-ft. contours were then begun and carried on with the aid of one assistant carrying a stadia rod. In many cases the assistant was sent to outcrops with rod and hammer to give a reading and to bring back a specimen. Although this system saved much climbing for the geologist it could be used only where inspection of the outcrop from the planetable made the character of the rock fairly certain, and it is not to be generally recommended. Magnetic stadia traverses were run at intervals as required and frequent checks on position were possible by the three-point location from known points.

The total time occupied in this piece of work was 30 days, and the time spent actually in the field was 16 days. The total cost was about $175 or about $35 per square mile. This work was done in Chosen, where the cost was probably somewhat less than it would be in the United States.

It must be borne in mind that a high degree of accuracy and speed with the planetable does not come without great care and practice in manipulation. For instance, the refinements of close scaling (traverses have been run in which the distances have been plotted to scale by the naked eye to less than 1/500 of an inch), of a properly sharpened plotting needle, of the wedge-pointed hard lead pencil, of the extension of the lines of sight on the edges of the paper and of drawing lines from the centers of the small needle holes must be appreciated and acted upon in order to secure thoroughly satisfactory results. But even without much practice, fair and rapid results may be obtained.

With regard to the carrying of the planetable it may be said that some planetable users have noticed that after a few weeks in the field it is easier to get over rough ground with the planetable than without it. The reason for this is that the light tripod is often used as an alpine staff, and at other times the planetable can be used advantageously to balance one's self. In fact, one is conscious of a peculiar sensation of insecurity when in difficult positions without its friendly assistance.

And lastly, attention must be called to a characteristic of the planetable which has often been remarked upon in conversation by topographers but which doubtless has seldom found its way into print. Anyone who has seen the topographer or geologist poring over the map on his planetable of an evening after a strenuous day's field work can realize that the planetable has risen from the rank of a mere scientific instrument to that of a creative instrument; for in addition to its scientific value the work of an honest and enthusiastic mappist is in the truest sense artistic and creative. Thus in the common cause of earnest effort to record Nature's truths, the instrument and the man become in a way a part of each other. Often alone, and far from camp, the days and weeks spent together in the field, meeting common dangers and solving common problems, develop a feeling of comradeship which can scarcely be appreciated except by those who have had the experience themselves. The notebook cannot rise to this degree of esthetic merit.



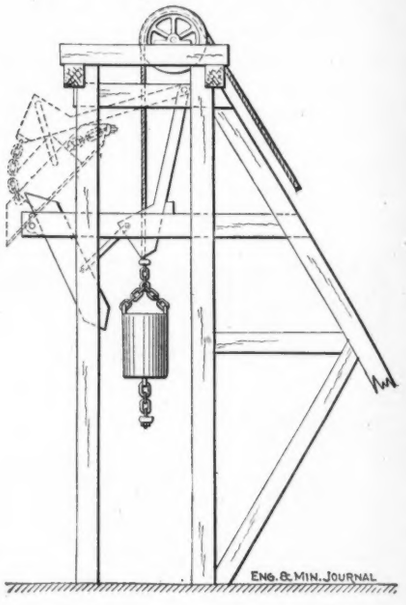
PLANETABLE TRIANGULATION NET

At some of the U. S. Smelting, Refining & Mining Co.'s mines, a considerable saving is being made on mine-car wheels. When the tread of a wheel becomes worn, it is machined down so that a steel band can be shrunk on the rim. When tempered carefully, the new rim lasts three times as long as the original cast rim and can be replaced whenever worn.

A Direct Automatic Bucket Tipple

By OLIN S. PROCTOR*

A direct automatic bucket tipple has recently been devised so that lowering and raising the bucket in the shaft completes the operation without any short lifts with the hoist or the manipulation of catches or triggers. The special mechanism comprises a tilting chute provided with a bale, a swinging arm and two balls; one ball is attached to the cable just above the bucket and the other to the bottom of the bucket by a short chain. The bucket in the dumped position can be carried up close to the sheave wheel, thus giving room for chutes or for bins the height of the head frame.



DIRECT AUTOMATIC BUCKET TIPPLE

The regular four-post head frame with the usual bracing is shown, but this device can easily be adapted to almost any headframe, since there are only two pivot points to be supported in proper relation to each other and the cable. Considering the chute as the front, the swinging arm is hung on a shaft or hinge behind the cable up near the sheave wheel. Usually this can be done by passing a piece of shafting through timbers of the headframe and the swinging arm. When the bucket is down the swinging arm rests against a cross timber so the cable plays freely through the slot or hole formed in the lower end of the swinging arm. When the bucket is hoisted the ball on the cable comes in contact with the lower end of the swinging arm, which causes the bucket to move up and over into the tilting chute. At this time the arm, acting through the bale of the chute, tilts the back end of

*Mechanical engineer, 150 Nassau St., New York.

the chute up to an angle of about 50° to the horizontal.

The bucket is prevented from sliding down the chute by the ball attached to the bottom engaging a V-shaped notch in the rear of the chute. The weight of the bucket carries the chute and arm back to the normal position when the cable is slacked to lower. This simple mechanism makes the operation of a bucket as fast or faster than a cage, and it works on incline or vertical shafts. It is being placed on the market by the Proctor Engineering Co., 150 Nassau St., New York.

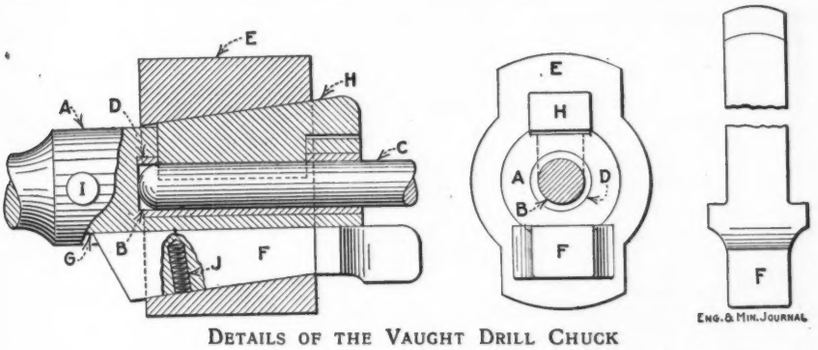
The Vaught Drill Chuck

The drill chuck illustrated in the accompanying sketches was invented by J. C. H. Vaught, now of Calumet, Mich., who claims that the device has been successfully used in the Bunker Hill & Sullivan mine in the Cœur d'Alene district in Idaho, in the Argonaut mine at Jackson, Calif., in the Copper Queen at Bisbee, Ariz., in Goldfield Consolidated, Tonopah Midway, Anaconda, and Butte & Superior mines. The advantages claimed for the invention are that when once assembled the parts that make up the chuck cannot unintentionally be taken apart, no U-bolts are used to hold the drill steel, there are no nuts to tighten and loosen and the steels may be changed by striking the shouldered releasing and retaining key *F* a blow with a hammer or wrench which will force the sliding sleeve *E* to disengage with the gib *H*, thereby leaving the steel free to be renewed at will by the operator, and as soon as another steel has been inserted in the socket, the air may be turned on instantly and with the first impact of the piston, the sliding sleeve is forced forward on the tapered face of the gib *H*, causing the latter to engage the drill shank positively. The design is such that when in operation the chuck tends to grip the steel tighter rather than to lose hold by the shock and vibration of the piston.

In the accompanying sketch, *A* is the chuck proper; *B*, the opening in the chuck to receive the shank of the drill steel *C*. This opening is lined with the bushing *D*. The chuck proper is enveloped by the sliding chuck-sleeve *E*, within which is cut a groove in which is fitted a shouldered releasing and retaining key *F* that also fits in the keyway *G*. On the opposite side of the chuck body a slot is provided to receive the gib *H* which is brought to bear upon the drill shank *C*, through the pressure exerted by the sleeve *E* upon the gib when the sleeve is forced forward by the impact of the drill steel with the rock. A groove is cut in the sliding sleeve to receive the gib. As shown below *H*, the chuck and bushing extend below the main part of the gib *H*, so that the gib cannot slide out from beneath the chuck sleeve.

The retaining and releasing key *F* is prevented from sliding out of the sleeve by the enlargement at the rear end; the chuck on account of the tapered gib *H*, and the pin *I* limits the extent to which it can slide upward, thus neither gib nor key can fall out.

A spring *J* in a recess in the key *F* holds the sleeve back and off the gib while replacing the drill steel. This design, as shown in the sketches, should permit of making an unusually strong chuck and it would seem that no part of the device is as weak as the U-bolt used in so many similar devices.



DETAILS OF THE VAUGHT DRILL CHUCK

Method of Locating a Shaft

BY J. B. MOORE*

The method of locating a shaft as herein described has, I believe, some advantages over the method described by H. G. Henderson in an article entitled "Survey Method of Locating a Shaft," and published in the JOURNAL of Nov. 23, 1912.

First select the place underground through which the shaft is to be sunk and mark each corner. Then begin at the mouth of the adit and survey it to within a few feet of this place and from the last setup of the instrument sight and measure to each corner of the proposed shaft and calculate the total coördinates of the survey to these points. Then return to the starting point of the survey and carry it outside to within 10 or 20 ft. of the shaft location, figuring the coordinates as the survey is made. From the last point calculate the distance and direction to points vertically above the corners of the shaft marked underground, then set up the instrument on the last point of the survey, turn the required angles and measure and mark each of these points which will be the corners of the shaft.

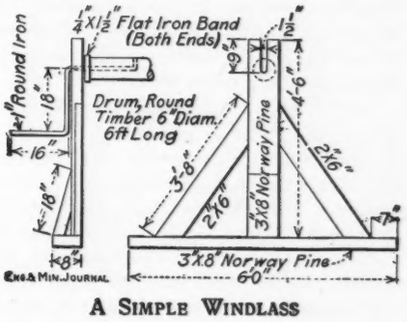
By selecting a position for the last setup so that the measurements to each corner can be made horizontally the operation is very simple and can be done in one visit to the mine. Then work may be started at both ends of the shaft if desired.

*Superintendent, Jimulco Mining Co., Otto., Coah., Mexico.

Test Pit Windlass

BY L. D. DAVENPORT*

In the open-pit mines of the Chisholm district, Minnesota, it is the custom during the winter season to put down a large number of test pits in the ore for exploration purposes. These pits are usually about 3x4 ft. in cross-section and range in depth from 10 ft. to 80 ft. The accompanying sketch shows the details of the windlass used to hoist the ore from these pits. Four railroad ties are placed around the mouth of the test pit to form a collar and the bottom of the windlass frame is spiked to this collar. The windlasses used for underground test pits are made on the same general plan, except that they are smaller.



A SIMPLE WINDLASS

Utilizing Discarded Brass Screens

It is a comparatively simple matter for any machinist to make small brass castings in the usual run of machine-shop work at a mine or mill. As a rule the work is simpler than making iron castings and the metal may be melted in graphite crucibles, such as are used for melting amalgam sponge or cyanide precipitate. Sand or clay may be used for molding.

If brass screen cloth is used in the mill, a supply of brass can be obtained

*Engineer, Oliver Iron Mining Co., Mesaba, Minn.

at practically no cost. The discarded screens are carefully washed, folded up into a compact mass, dried and dropped into the crucible in the furnace. Screens so melted may remain in the crucible a long time without melting, greatly retarding the work. The remedy is simple and consists in melting a few pieces of scrap brass, so that the wads of screen cloth can be partly submerged in molten metal when dropped into the crucible. A large number of screens can thus be melted in a short time.

An Electric Battery for Blasting

By C. Carleton Semple

There is a notion entertained by many miners, that electric detonators cannot be used in blasting except in conjunction with a magneto machine or a lighting or power circuit, but comparatively few mines are lighted by electricity and still fewer are wired for power. Blasting machines are rather expensive, especially for the man mining on a small scale. In order that they may be used conveniently several machines will be needed on every working level, and in case operations are on even a moderate scale, the initial cost of an adequate supply of blasting machines amounts to no mean total.

Furthermore, the magneto machine is notoriously liable to get out of order and to be affected by dampness. Its mechanism is not easily comprehended by many miners who might be called upon to make their own repairs. It is these reasons as well as vague notions entertained by some as to the difficulties of wiring, that are accountable for the fact that in mines fuse is still the favorite means of detonating explosives, even for work under water. The advent of first- and second-delay action detonators has made it possible to secure the desired intervals between the breaking of groups of holes in a round in electric blasting.

A cheap blasting machine can be made by using dry batteries such as are usually sold for about 20 to 25c. each for electric call-bell work. While I have been unable to thoroughly test out such a battery, I have secured excellent results which warrant my suggesting the device to those who can. I have found that at least two caps can be detonated for each cell in the battery. This would indicate that a battery of eight cells should suffice for any ordinary drift round.

The eight cells may be placed in a wooden box, conveniently in two rows of four cells in the row. The cells should be connected in series; one battery terminal being connected to one of two binding posts placed near together at one end of the box. The other battery terminal should be connected to the center of a two-point switch secured to the end of the box near the two binding posts. One point of the switch should be connected to the second binding post; the second point of the switch, not being connected, is the off position. The box should be equipped with a substantial hinged cover, preferably locked in place, and a stout strap which may be slung over the shoulder for carrying the battery about.

The operation is simple. The switch is carried on the off or blank point. The wires from the round are secured in the binding posts and when ready to blast the switch is slipped over to the other position. The effect is, of course, instantaneous unless an attempt is made to fire too many holes for the number of batteries used. While the flow of current is strong, the circuit is broken so quickly by the detonation of the charges that the dry cells should recover quickly and be serviceable for a long time. How long, I am unable to state, as I have not yet had opportunity to blast frequently enough to exhaust a battery.

It is a simple matter to arrange such a battery so that the circuit may be tested by sending through a small current before switching on the full current of all the cells in series. I have found that 1 lb. of No. 22 copper magnet wire, wound on a spool for convenience, placed in the circuit of only one electric detonator, will enable one to send the current of one dry cell through the circuit without exploding the detonator. If, then, the battery box is so arranged with one cell in circuit with such a spool of wire for resistance, it will be possible to arrange a three-point switch in such a manner that the lead wires from the round may be attached to the binding posts while the switch is on the blank point. Obtaining a spark at the switch while making and breaking contact with the second point to which the single cell and coil of wire is connected, would indicate a closed circuit which will be fired upon throwing the switch over to the third point to which all the cells of the battery are connected. A still more elaborate device can be made by placing a cheap and simple galvanometer on the end of the box connected with the second point of the three-point switch and the one cell and resistance coil; the movement of the needle would then indicate a closed circuit much better than would sparking at the switch.

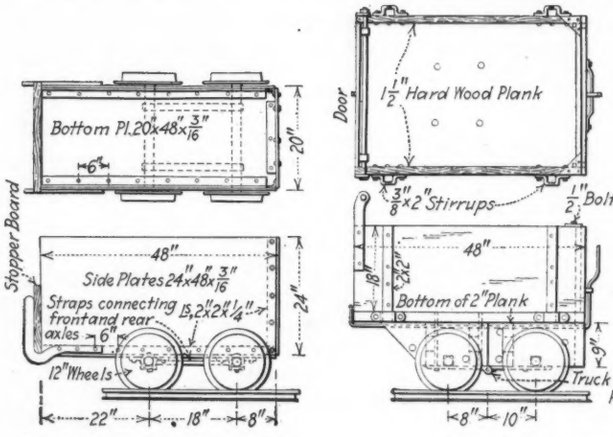


Fig. 1. Steel Sublevel Car

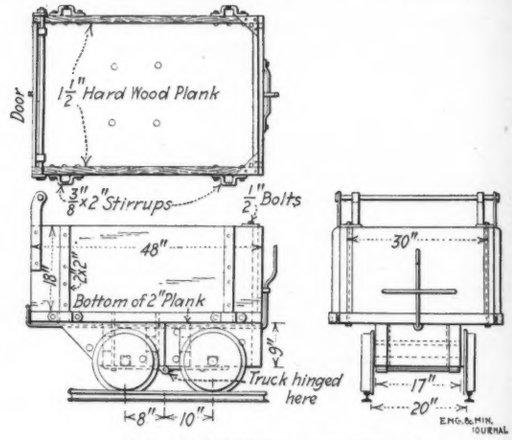


Fig. 2. Wooden Sublevel Car

Sublevel Tram Cars

By H. L. Botsford*

In the sublevel system of mining there is need for a special tram-car which can be easily brought into and removed from the subdrifts. The only access to the subdrifts is usually by a raise or winze through which it is impossible or inconvenient to take the main-level cars.

The accompanying illustrations show two types of small tram-cars which are well adapted to this work. They are so constructed as to be dismantled for moving, and quickly assembled. A light steel car is shown in Fig. 1. The sides are bolted to the bottom and the end to the bottom and sides. The front axle only is bolted to the car box. The front and rear axles are connected by straps, so that the box lifts off the rear axle when being dumped. A wooden car, built with detachable sides and end is shown in Fig. 2. The truck is hinged, and only the front half is fastened to the car box. The sides of the car are provided with cleats which fit into stirrups bolted to the bottom planking.

A satisfactory pipe vise can be made from an ordinary steel vise by taking a piece of coarse sandpaper about 3 in. x 6 in. in size and after doubling it place it around the pipe, then place the part with the sandpaper on it between the jaws of the vise and tighten, says the November, 1912, *Pemberthy Engineer and Fireman.* The pipe may then be either threaded or cut without difficulty.

*Creighton Mine, Ontario.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

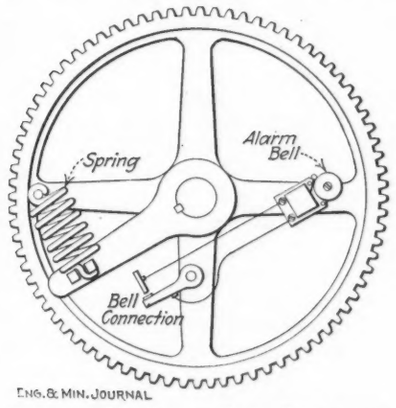
Overload Alarm for Dorr Thickeners

An interesting and ingenious device has been arranged to be placed on Dorr thickener tanks to call attention to an overloaded condition. The arrangement is as follows:

Above the usual gear wheel, which moves the vertical shaft, is placed a cast-iron arm keyed to the vertical shaft. The gear wheel itself is not keyed to the shaft, but is loose on it and free to move independently. The arm and gear wheel are connected by means of a spring, the tension of which may be adjusted for working conditions. The power being applied, as usual, to the gear wheel, the arm is moved through the spring, and the vertical shaft moves with the arm. However, should the load be too heavy, the gear wheel continues to move but the arm remains stationary, the load on the shaft being too much for the spring, which opens. Hence the relative position of the arm and gear wheel is not maintained and the arm drags back.

When the arm has moved, with reference to the gear wheel, a few inches, it presses on a small plunger rod, which makes an electrical connection and rings a bell. The connection and bell are fixed on the large gear wheel, and the movement of the arm need be only small to make the connection and ring the bell. Attention is thus immediately called to the condition of the thickener and the mill man takes immediate steps to lighten the load by cutting off the feed to the machine or increasing the discharge or any other convenient method.

The contrivance works well and is of great use on thickeners, particularly where the feed or discharge to them is variable. It is used on the Dorr thickeners at the mill of the Blue Flag Gold Mining Co., of Cripple Creek.



OVERLOAD ALARM ON DORR THICKENER

Bumping Picking Table

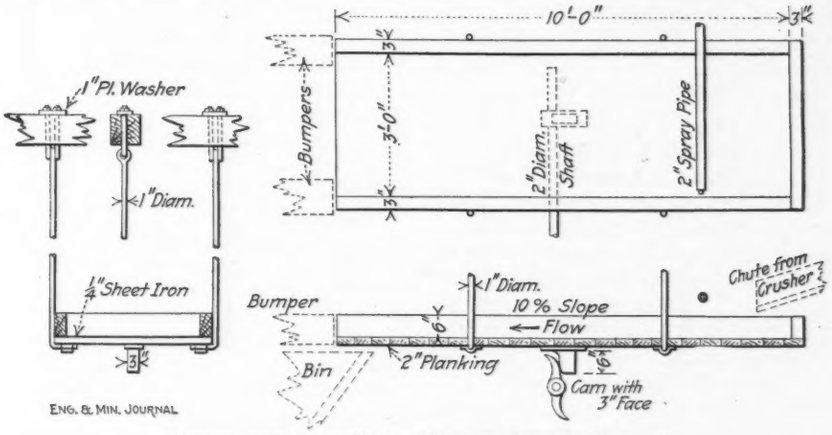
BY EDWARD H. ORSER*

During the first days of mining in and around the Cobalt district, most of the mining companies erected small rock houses in order to cut out as much of the waste rock from the hoisted material as possible. In these plants hand-picking was almost unanimously resorted to, and was carried on by either dry picking or "cribbing," or else on moving tables where the broken ore was subjected to the washing action of a stream of water. In this way the ore was made more easily discernible.

The accompanying sketch is intended to show one of these tables. It is essentially an inclined tray hung from the roof timbers by four iron rods. The upper end is under the chute from the crusher, and the lower end extends over the bin for waste. The bumping is accomplished by the use of a cam-and-tappet arrangement on the under side of the tables and driven from the main lineshaft by pulley and belt.

The swing of the table is about one foot On its return it strikes a bumper of timber at the lower end. This action, and the inclination of the tables, which is about 10%, effect the forward movement of the material at a rate not too fast for clean picking. A 2-in. spray pipe at the upper end of the table supplies the wash water, and this can be regulated by a 2-in. globe valve on the pipe.

*9 Frontenac St., Kingston, Ont.



BUMPING PICKING TABLE USED IN COBALT DISTRICT

Slotted vs. Round-Hole Trommel Screens

BY R. S. HANDY*

At intervals during the last year I have been experimenting with slotted punched-steel screens in an effort to find something to replace the round-hole screens on trommels, which, in my experience, have always shown low efficiencies.

My first order for slotted screens was as follows: One 30x151-in. steel screen, ¼-in. gage, punched with slots 10 mm. wide by 1 in. long; one 30x151-in. steel screen, $\frac{3}{16}$-in. gage, punched with slots 7 mm. x ¾ in.; one 30x151-in. steel screen, ⅛-in. gage, punched with slots 5 mm. x ½ in.; slots to run with the circumference and to be staggered, as in Fig. 1. When these screens were put in the place of round-hole screens, with the width of the slot corresponding to the respective diameter of the round-hole, the jigs receiving their feed from the slotted trommels were swamped with feed and the slotted screens had to be removed. The 7-mm. slotted screen was then put in place of a 10-mm. round-hole screen. Table I shows the screen tests on the oversize of these two screens.

The 10-mm. slotted screen was substituted for an 18-mm. round-hole, and the 5-mm. for a 7-mm. round-hole screen; each gave as good service and slightly better oversize screening tests than the round-hole screen which it replaced.

The results of these tests were encouraging but, with the exception of the

*Mill superintendent, Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho.

5-mm. size, the slotted screens "blinded" greatly, and there was too large a proportion of elongated pieces in the undersize. To overcome these faults the gage of the steel and the length of the slots were changed and the following screens

TABLE I. COMPARATIVE GRADING ANALYSES OF TROMMEL OVERSIZE

	Oversize 10mm. Round-hole %	Oversize 7mm. Slotted Screen %
+10mm	84.2	87.4
+7mm	11.2	11.8
+5mm	4.1	0.8
—5mm	0.5	....

were ordered: Three 30x153-in. steel screens, No. 14 W. & M. gage, closely punched with oblong slots, running with the circumference, 3 mm. wide by $\frac{3}{16}$ in. long; one 30x153-in. steel screen, $\frac{1}{8}$-in. gage, punched as closely as possible with oblong slots, as above, 7 mm. wide by $\frac{3}{8}$ in. long; screens to be rolled to a 4-ft. circle, with the small side of the slot inside.

These screens were lately put into service on the middlings side of the Bunker Hill & Sullivan West Mill No. 2 in competition with double the number of equivalent round-hole screens handling the same tonnage of about the same size material on the original-feed side of the same mill.

Results of a test covering eight hours of regular service of these trommels are shown in Tables II and III. In Table II are given the screen tests on products (samples 1 and 2) from two trommels, each consisting of 180 in. of 3-mm. round-hole screen and 60 in. of 7-mm. round-hole screen; and on the oversize (sample 3) of two Bunker Hill screens with 22-mesh, long-slot, woven-wire screens. Table III shows the screen tests of products (samples 4 and 5) from one trommel having 90 in. of 3-mm. slotted screen and 30 in. of 7-mm. slotted screen; and of the oversize (sample 6) of two Bunker Hill screens with 20-mesh, long-slot, woven-wire screens. Reference to the accompanying flow sheet will make clear the arrangement of the trommels.

It is interesting to note that the slotted screens are showing no tendency to blind, while the round-hole screens have to be cleaned at intervals.

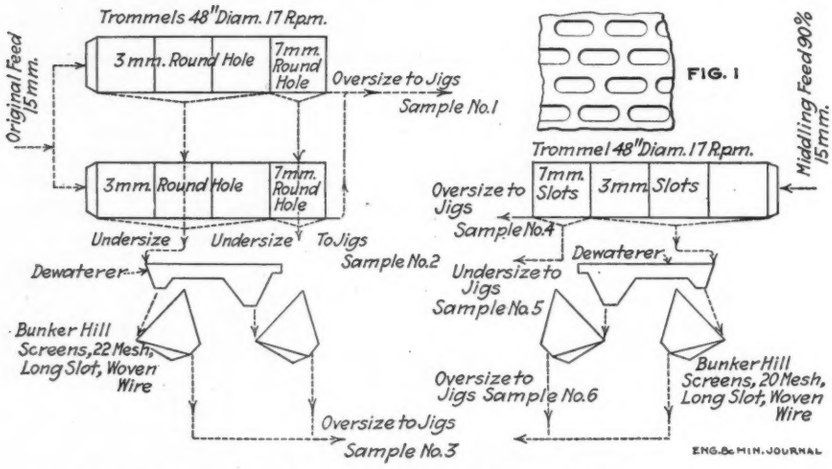
The specifications for the original-feed trommels are as follows: Six 30x153-in.

TABLE II. GRADING TESTS ON PRODUCTS OF ROUND-HOLE TROMMELS AND BUNKER HILL SCREENS

Standard Screens	Sample No. 1 Oversize 7mm %	Sample No. 2 Oversize 3mm %	Sample No. 3 Oversize 22 mesh %
+7mm	64.6	....	....
—7mm	35.1	....	....
+3mm	....	89.2	....
—3mm	....	10.8	....
+20 mesh	....	....	77.5
—20 mesh	....	....	22.3

steel screens No. 14 W. & M. gage, closely punched with 3-mm. round holes; two 30x151-in. steel screens, $\frac{1}{4}$-in. gage, punched with 7-mm. round holes, $\frac{7}{16}$ in. centers; the screens to be rolled as above.

The inefficiency of round-hole trommels is due, I believe, to the fact that in their operation they hold the mass of the pulp away from the full opening of the orifices in the bottom of the trommel and up on the side at an angle of about 20° with the horizontal. A vertical projection of a 30-mm. round opening in a screen



ARRANGEMENT OF TROMMELS FOR COMPARATIVE TESTS

TABLE III. GRADING TESTS ON PRODUCTS OF SLOTTED SCREENS

Standard Screens	Sample No. 4 Oversize 7mm %	Sample No. 5 Oversize 3mm %	Sample No. 6 Oversize 20 mesh %
+7mm	89.6	....	....
—7mm	10.4	....	....
+3mm	....	97.7	....
—3mm	....	2.3	....
+20 mesh	....	....	90.9
—20 mesh	....	....	9.1

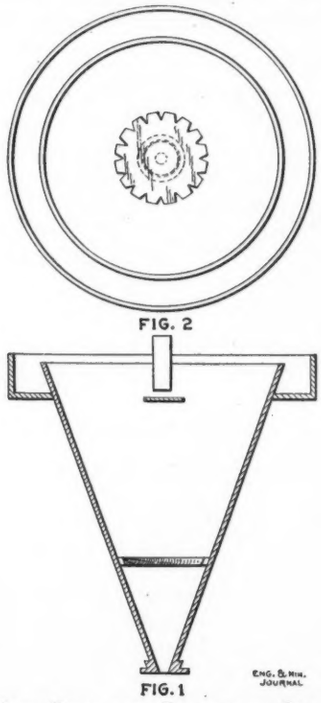
$\frac{1}{2}$ in. thick on a 4-ft. trommel at this angle is only about 16 mm. wide. That is, the largest particle which could fall freely through a 30-mm. hole at this angle would be 16 mm. wide. This ratio decreases as the sizes grow smaller, until a projection of a 3-mm. hole in a 14-gage screen is little more than one millimeter wide. It is not surprising, then, to find the efficiency of round-hole trommels decreasing as the sizes grow smaller.

It was this condition which led me to the slotted form of screen and I endeavored to arrange the length of the slots and the gage of the steel so that a vertical projection of the slot at an angle of 20° would be a circle of the same diameter as the width of the slot.

The Bunker Hill ore breaks to a granular form, and in this there is some advantage in favor of the slotted screen, but I believe the dimensions of the slots and the gage of the steel could be arranged to give high efficiencies with trommels on almost any ore.

Improved Caldecott Cone

W. A. Caldecott, of Johannesburg, has patented (U. S. pat. 1,008,524) the use of a circumferentially notched plate to assist in the settlement of solids in overflow classifiers. The object is to avoid the holes or passages which form in the ordinary classifier in the solids, which result in sudden rushes of the liquid through the aperture in the bottom of the vessel. In large tanks, there may be perforations in the plate, as well as circumferential notches. The accompanying illustration shows a notched plate in a conical classifier.



NEW DISK FOR CALDECOTT CONE

Increased efficiency in concentration at the Federal mill, Flat River, Mo., is attributed to the use of Esperanza-Federal classifiers because they give a clean separation of sand and slime and also furnish an even table feed by acting as accumulators.

Notes from Current Literature

Concerning Mining, Metallurgy and Industrial Chemistry

The Tantalum Industry

The first use which brought tantalum into great prominence was making filaments for incandescent lamps. The first successful metallic filaments were made from it, and owing to the toughness of the wire it seemed likely that it would remain a valuable material for this purpose, for although its efficiency was lower than that of the tungsten lamp, the first tungsten filaments were so brittle as to make their carriage precarious.

However, processes have now been devised by which tungsten wire can be drawn nearly as tough as the tantalum, and the tantalum lamps are being driven from the markets. It has been recommended for making surgical and dental instruments, pens and other such small apparatus, but apparently the first workers in this metal overestimated its hardness and such uses will not be as important as at first promised.

No tantalum minerals are known to have been produced in the United States during 1911, according to the U. S. Geological Survey, except a few hundred pounds of columbite, produced by Emil E. Hefnard, Custer, S. D., which was sold for mineralogical specimens. There was a considerable quantity of tantalum wire imported from Siemens & Halske, of Berlin, Germany, during the year.

Determination of CO_2 and H_2O in Minerals

Water and carbon dioxide are found by Dittrich and Eitel to be completely expelled from minerals and rocks by heating to a sufficiently high temperature in a current of dry air, and the authors describe (*Zeit. anorg. Chem.*, p. 365, 1912; *Journ. Soc. Chem. Ind.*, Nov. 15, 1912) apparatus by means of which, except in substances containing organic matter, graphite, or much fluorine, these constituents may be determined in a single operation. For temperatures below 1000° C., the heating is effected in a tube of quartz glass, the substance being contained in a platinum boat, and for higher temperatures, up to 1400° C., a tube and boat of platinum-iridium (10% of iridium) are employed. The heating, in either case, is effected by means of an electric resistance furnace, and the evolved water and carbon dioxide are collected in absorption apparatus in the usual way, the purifying and absorption apparatus being connected to the heating tube by ground joints. For the retention of sulphur and halogens, a roll of silver gauze, heated by a bunsen flame, is placed in the forward part of the tube, or, with a quartz tube, a heated mixture of lead oxide and peroxide may be employed. The results obtained are in agreement with those given by the Ludwig and Sipöcz method for the determination of water in silicates, as modified by the authors (*Zeit. anorg. Chem.*, 1912, p. 373).

Selenium Glass

The use of selenium as a coloring matter or "stain" in glass, dates from 1891 (*Chem. Zeit.*, p. 1149, 1912; abstr. *Journ.* Soc. Chem. Ind., p. 1033, 1912), when Welz patented the use of selenium alone or with cadmium sulphide for producing a red or orange "stain." In 1894, Spitzer used selenites or selenates in conjunction with sulphites or arsenites, the latter acting as reducing agents. A year later, selenium in combination with gold was employed for red colors and as a decolorizer in white glass. For discharging the green color due to iron, selenium is a valuable agent. In order to study the physical and chemical condition of selenium in glass, the author used a glass of the formula: $6SiO_2CaO2Na_2O$, which was heated for 24 to 30 hr. at 1400° C. He finds that the element selenium can only produce a red under strongly reducing conditions. The pigment is in a condition of true solution, but if by insufficient reduction the "stain" is not fully developed it is not all dissolved. The coloration depends on the reduction and not on temperature nor length of firing. There may also exist in solution, in a colloidal state, selenites of the type, M_2Se, and compounds less oxidized than selenites, of a type similar to thiosulphates. These colloidal solutions are sometimes colored, sometimes not.

Constitution of Aluminates

We are in the habit of thinking of the hydrated oxide of aluminum acting as an acid in the formation of aluminates, but from experiments by Edward G. Mahin, of Purdue, detailed before the International Congress of Applied Chemistry, it appears that the colloidal character of alumina has more to do with its solubility in alkalis that has its possession of any amphoteric characteristics, that is, alumina is a base, and goes into colloidal solution in alkalis, and not as the acid radical of a salt.

These experiments included: The heat of solution of $Al(OH)_3$ in NaOH; the quantity of $Al(OH)_3$ precipitated by a known weight of $NaNO_3$ from a Na_3AlO_3 solution; and the relative weights of aluminum oxide and oxygen produced by electrolysis of an Na_3AlO_3 solution.

[If these conclusions are correct for fusions, it will have a great influence on our ideas of slag formation.—EDITOR.]

Marr Timber Preserving Process

A new process for the preservation of timber is that of R. A. Marr, of Richmond, Va. The preservative material is melted paraffin with silica in suspension, together with a percentage of naphthalene. The silica used is a diatomaceous earth of which 92% will pass 200 meshes to the linear inch. The naphthalene is supposed to cause expansion of the pores and cells of the wood, and to get up an active circulation, expelling the moisture and sap from the pores and drawing in the preservative mixture. This mixture, upon cooling, forms a solid coating over all the interior cells and pores. It does not leach out, it is impervious to water and all organic acids, and being also antiseptic it prevents the entrance of spores which cause wood to decay says *Engineering News*, Nov. 21, 1912.

It is claimed that wood can be permeated to the center, regardless of the dimensions of the timber, in a maximum of four hours as against 12 to 24 hours for creosoting. The treatment, it is claimed, will prevent checking, adds resilience to the timber, and renders it immume to the attacks of the teredo and other marine borers, owing to the hardness of the contained silica. The treatment is claimed to be successful with white oak and other hard woods which are impenetrable by other process. The process is an open-tank one, the experimental plant consisting of a vertical cylindrical tank just large enough to admit a railroad tie and jacketed to retain the heat furnished by a gasoline burner beneath the tank. This contains about 125 lb. of the preservative.

The ties were dipped vertically, and were handled by a block and tackle on a gallows frame. Wood treated by this process, it is claimed, does not become waterlogged, no matter how deeply or how long it may be submerged in water.

Spikes and nails hold better than in creosoted or in untreated wood, and will not rust. The cost of the preservative is about 3c. per lb., and it is claimed that complete protection may be afforded by this method and material, at a cost greatly below that of creosoting or any other known treatment. For complete impregnation of oak and pine it requires about 1.65 to 2.0 lb. of solution per cubic foot of timber. Unseasoned timber is said to respond as readily to treatment as does seasoned. If the claims made are true the process should have a wide field in the treatment of mine timbers.

Preparation of Borax and Boric Acid

The preparation of borax and boric acid is thus described by E. L. Fleming and T. L. Miller in French pat. No. 442,820. Natural calcium borate or the double borate of calcium and sodium is boiled and agitated with a solution of sodium sesquicarbonate, until decomposition is complete. The calcium carbonate produced is separated centrifugally and the solution cooled, so as to bring about crystallization of the borax. Boric acid is obtained by concentrating the mother-liquor and treating it with chlorine (obtained electrolytically from brine), the boric acid being made to crystallize by cooling the solution, and sodium chlorate may be recovered from the mother-liquor. Both the borax and boric acid are separated and dried in centrifugal apparatus. The sesquicarbonate required may be prepared by carbonating the sodium hydroxide obtained by electrolysis.

Radium from Autunite

The possibility of using phosphatic uranium micas, such as autunite (phosphate of uranium and lime) and copper autunite, as a source of radium is discussed by F. Glaser (*Chem. Zeit.*, p. 1166, 1912, abstr. *Journ.* Soc. Chem. Ind., p. 1030, 1912). The determination of the uranium content of such ores is accomplished by the separation of uranium from iron by means of ammonium carbonate. If dilute solutions are used, with a large excess of ammonium carbonate, there is no danger of uranium being carried down with the iron precipitate, while all the phosphoric acid will be combined with the iron. A little iron remains in solution with the uranium and is subsequently precipitated with it.

This is removed by fusing the ignited and weighted precipitate with potassium bisulphate, dissolving in water, filtering and treating the filtrate with ammonia and ammonium sulphide. The iron is precipitated on standing, while the uranium remains in solution. The specimens of Portuguese rocks containing autunite examined by the author have yielded from 0.1 to 4.5% of U_3O_8. For separation of the uranium the autunite is extracted with hydrochloric acid, and the extract neutralized with lime, which precipitates uranium, copper, radium and iron. Another method of decomposing the mineral is to boil with sodium carbonate, when the uranium is dissolved and the radium retained. This process is slow for calcium autunite, but more rapid for copper autunite, from which, however, some copper goes into solution with the uranium. It is found that appreciable quantities of sulphuric acid in the commercial hydrochloric acid used for extraction, do not greatly decrease the amount of radium extracted, in spite of the very low solubility of radium sulphate. Presumably this solubility is increased by the ferric salts, etc., which are also present. Although the processes of extraction are thus comparatively simple, the profitable working of calcium autunite is only possible where the percentage of uranium is exceptionally high.

Gravimetric Separation of Zinc and Nickel

The gravimetric separation of zinc and nickel has been investigated by Cockburn, Gardiner and Black (*Analyst*, p. 443, 1912), special attention being directed to obtaining zinc sulphide in a form in which it could be filtered readily.

The precipitation of zinc sulphide from an acetic acid solution yields satisfactory results under the following conditions, the average error in the weight of zinc found being 0.0004 gram with quantities of zinc varying from 0.1 to 0.7 gram and when the amount of nickel did not exceed 0.2 gram. The slightly acid solution of the two metals is treated with sodium carbonate until a faint turbidity is produced, 100 c.c. of glacial acetic acid are then added, the mixture is cooled, and hydrogen sulphide is passed through it at the rate of two bubbles per second for one hour. After standing for a few hours, the zinc sulphide is collected on a filter, washed with hydrogen-sulphide solution containing 2% of ammonium acetate, dried, ignited and weighed as oxide. The zinc oxide obtained does not yield a reaction for nickel when submitted to Tschugaeff's test.

For the precipitation of zinc as zinc sulphide in presence of formic acid, the acid solution of the metals is rendered neutral to methyl orange by the addition of sodium hydroxide solution, a 50% formic-acid solution is added drop by drop until the mixture is acid, 0.5 c.c. is added in excess, the whole is diluted with water until 100 c.c. contain not more than 0.2 gram of zinc, then heated to 80° C., and treated with hydrogen sulphide. The zinc sulphide is collected on a filter, washed with hot water, and ignited to oxide. This method also yields accurate results when the proportion of nickel is not too high.

The precipitation of zinc as sulphide from a solution faintly acid with hydrochloric acid, and Zimmermann's process (*Ann. Chem. Pharm.*, 1897, p. 3) yielded unsatisfactory results. With a view to determining the nickel in the filtrate from the zinc sulphide, the authors investigated the process described by Dede, but could not obtain trustworthy results, owing to the occlusion of alkali by the precipitate. Accurate results were obtained by the dimethylglyoxime method of separating nickel from zinc.

Metallizing Siliceous Surfaces

A process of giving a metal coating to siliceous surfaces, such as those of glass, pottery and the like, is given in *La Revue des Produits Chimiques*, Oct. 20, 1912. The method consists in treating the surface, which must not be enameled or varnished, with a solution of silver fluoride and then exposing it to the action of a current of illuminating gas. The article is later exposed to a temperature of about 50° C., and while at that temperature exposed to a current of bisulphide of carbon. These operations result in the deposition of a finely divided deposit of silver on the nonconducting surface. To secure the best results this deposit should then be burnished, after which it can be used as cathode in an electrolytic bath for the deposition of any metal.

Electric Furnace Pig Iron

Analyses of the ore used by the Noble Electric Steel Co., at Heroult, Calif., and of the product made from it, are given by Lyon and Langenberg, in *Metallurgical and Chemical Engineering*, August, 1912:

ORE ANALYSIS

	%		%
Fe	69.9	MgO	0.30
Fe_3O_4	89.4	SiO_2	2.40
Fe_2O_3	7.3	P	0.011
MnO	0.18	S	0.009

PIG IRON ANALYSIS

	%		%
Si	3.64	C(comb.)	0.00
S	0.00	C(total)	3.58
P	0.02	Mn	0.00

Alizarin as an Indicator

Using alizarin as an indicator (*Journ.* Soc. Chem. Ind., p. 1030, 1912) it was found that: (a) sodium sulphate, potassium sulphate and sodium nitrate each give an alkaline reaction when their aqueous solutions are boiled; (b) sodium chloride, potassium chloride and potassium nitrate do not give an alkaline reaction under similar conditions; (c) weak bases such as aniline are able to liberate a small quantity of caustic alkali from neutral salts such as sodium sulphate or chloride.

Nipissing High Grade Mill, Cobalt

By Herbert A. Megraw

A mill treating rich silver ore by a combination of amalgamation and cyanidation. Amalgamation is performed in a tube mill during the pulverization of the ore by the pebbles. Cyanidation is performed in wooden tanks with flat bottoms arranged for mechanical agitation. Cyanide for the whole treatment is added to the tube mill during amalgamation, and no lead salts are used. Precipitates are melted in a blast furnace and an oil-fired reverberatory furnace is used for melting and refining bullion.

The works of the Nipissing Mining Co. Ltd. is situated on the east side of Cobalt Lake, nearly opposite the town of Cobalt in Ontario. The company has had to solve a metallurgical problem that presented unusual features, and has resulted in a unique plant for milling the high-grade silver ore.

An Extremely Complex Ore

The ore to be treated contains a large variety of elements, among which may be mentioned about 40% arsenic, 6% cobalt, 6 to 7% nickel and varying percentages of antimony, manganese and a large amount of sulphur * * * *

In addition to the elements already mentioned, the ore is extremely rich in silver, being indeed, one which is not usually considered in any sense a milling ore. It carries from 2000 to 4000 oz. per ton, an average of 2500 oz. silver per ton being usual over long periods of time.

The suggestion of treating an ore of this grade, running nearly 80 kg. per ton in silver, by any milling process would be treated warily by most metallurgists, the difficulties certain to be encountered being more than most would care to face. The first impulse would be to ship this rich ore to a smeltery in the confidence that a nearly total extraction might be obtained at a cost lower than could be hoped for under milling conditions.

After careful consideration, however, the Nipissing Mining Co., Ltd. of which R. B. Watson is manager, came to the conclusion that the highest economy lay in treating the ore on the ground, making only one product—bullion. The problems of metallurgy were placed in the hands of Charles Butters, consulting metallurgist for the company, assisted by G. H. Clevenger and James Johnston, who built the mill and has since been in charge of it. The result is the so called high-grade mill * * * *

Ore of this character, containing as it does, pieces of rock of varying grade from nothing up to native silver, cannot be satisfactorily sampled in a coarse state. At the Nipissing mill the sampling is done after the ball mill has crushed the entire material to pass a 20-mesh screen, when it can be done with accuracy * * * *

As all the breaking and grinding up to this point is performed on the dry ore, there is naturally some dust formed, and it follows from the grade of the material that this dust contains a valuable quantity of silver. In order that this rich dust shall not be lost, pipes from a small exhaust fan are led to places where it can best be collected, the fan delivering into a baghouse from which point it may be returned to the treatment system.

The fine ore * * * * is taken to a platform over a 4x20-ft. Krupp tube mill. This portion of the metallurgy is unique and somewhat astonishing.

Note—Mr. Megraw, a member of the editorial staff of the Journal, studied the Nipissing process and prepared an article about it before Mr. Watson's article was received by us. We withheld Mr. Megraw's article in favor of Mr. Watson's, naturally giving precedence to a manager's account of his own process. However, Mr. Megraw makes some comments upon the process that are interesting, and we have thought it worth while to present his article minus paragraphs on the subjects that Mr. Watson has already treated fully. Inasmuch as this will cause Mr. Megraw's article to have a disjointed character, this explanation is due to him and our readers. This article is the third of a series by Mr. Megraw, of which previous articles appeared in the Journal of Nov. 2, 1912, and Nov. 23, 1912.—Editor.

Extraordinary Amalgamating Barrel

The tube mill has its axial entrances sealed up except for a small compressed-air pipe which enters it at one end and a corresponding air exit at the other end. The mill has the usual manholes in the tube, but these are seldom used. Instead there are three handholes with the usual covers equally spaced over the length of the mill on the same horizontal line. Through these holes the mill is charged and discharged, the larger holes being necessary only when relining or repairing inside the tube * * * *

Here, then, is a tube mill used as an amalgamating barrel, but under conditions which were probably never before sought for amalgamating purposes. The combination of an extremely high cyanide solution, a complex ore which contains all sorts of elements, and mercury all ground violently in a pebble mill, would seem to induce conditions quite the reverse of satisfactory. The natural expectation is that the mercury would become floured and that a large loss of it would be incurred. Particularly would this seem to be the case after the absorption of a quantity of silver would have resulted in the formation of amalgam with a tendency toward granulation, an ideal condition to be thoroughly "sickened" by the foreign elements in the ore.

Mercury Kept Clean by Cyanide

It is stated that this does not occur, which must be largely due to the strong cyanide solution keeping the mercury clean and allowing the fine particles to coalesce without hindrance from a coating of foreign substances. The heat formed in the mill may also have some effect in a beneficial way by tending to keep the mercury fluid and active. There is a great deal of heat generated in the mill, in fact steam would be formed were it not for the stream of compressed air which enters one axis of the mill and is discharged through a standing pipe at the other. This keeps down the temperature, though even with this cooling assistance the temperature of the mixture after completion of the agitation period is about 90 degrees.

No Lime or Lead Salts Used

It is noteworthy that neither lime nor lead salts are used during this process, and that after the agitation is complete, there is still sufficient cyanide to carry on the subsequent operations without further addition. The amount originally added to the tube mill is sufficient to produce a very strong solution, which is capable of partially outlasting the destroying effect encountered within the mill.

The agitation is continued for nine hours, after which time 97% of the contained silver has been extracted from the ore. The tube mill makes 37 r.p.m. and, contrary to the general practice of the day, is lined with silex brick.

Balanced Tube Mill Requires Low Power

The charge which is put into the mill fills it more than half full; there is little space left after putting in the total charge. This results in balancing the mill so that during the agitation process it requires only about 17 hp. to keep it in motion. When the mill is emptied of the charge and contains only the pebbles, it requires nearly 40 hp. to move it * * *

Cyanidation of the Ore Pulp

The agitating tanks are of the flat-bottomed type, having mechanical agitating appliances. These consist of a vertical shaft, to which arms are fixed, reaching nearly to the periphery of the tank. The vertical shaft is moved at a rate of 30 r.p.m., by means of crown wheel and pinion gearing. The high speed of these agitators is worthy of note, the necessity

for it being found in the high specific gravity of the ore, which is almost equal to an ordinary concentrate. Besides, the ore is so hard that only a small portion of it ever becomes a true slime, but remains in a granular form and has that tendency to settle characteristic of such material. The high speed is necessary to keep the solids in suspension * * * *

The striking feature of the cyanidation of the pulp is not in the method followed, which is the usual one, but in the fact that it is carried out in solutions, which must necessarily be in a state which is not usually regarded as being efficient for cyanidation. A consideration of what these solutions must contain, coming, as they do, from intimate contact with the conglomeration of elements found in the tube mill, will indicate that they must be more or less foul and in a condition which is not favorable to maximum efficiency. This matter will be referred to later * * * *

Precipitation on Zinc Shavings

The solutions are precipitated by means of zinc shavings in a box of the usual design, which has eight compartments, each compartment having room for about six cubic feet of zinc. The shaving used is rather coarser than that usually used, resembling a stout wire, the width of the shaving being nearly equal to the thickness of the sheet from which it is cut * * * *

The refinery department presents some unusual features. There are six retorts of the horizontal tubular type set in brick, each retort measuring 14x60 in. These retorts are heated by oil burners, thus making the operation simpler, cleaner and easier than when wood or coal is used. The oil burners are capable of generating a degree of heat which is entirely satisfactory and the operation is not troublesome * * * *

The precipitate from the cyanide department is mixed with a borax-soda flux of the composition usual for precipitate, briquetted and melted in a small blast furnace, together with the skimmings from the reverberatory furnace and other cleanings of value. This blast-furnace system of melting is not new, having been practiced before in different places. It is a good system when properly followed, but is not to be promiscuously recommended * * * *

Action of Cyanide during Amalgamation

From the standpoint of cyanidation there are several points about this metallurgy which attract attention. The first one is the use of a solution high in cyanide content for the amalgamation process. Of course, the intention is to use the cyanide entirely as an aid in amalgamation, there being not the least effort to put silver into solution during this stage. Nevertheless a portion of the silver must be dissolved along with a large number of other elements. The wonder is that there is any available cyanide left at all after the amalgamation period is over.

Is Mercury Dissolved?

A question which is naturally suggested is whether the mercury is dissolved to any extent, and if so, what becomes of it. Some authorities claim that mercury in the native state is not dissolved by cyanide solutions while others take the opposite view. I am inclined to believe that it depends a great deal upon conditions. A volume of mercury in quiet contact with cyanide solution will probably not dissolve to any great extent, but mercury in a finely divided state and amalgamated with other metals will be likely to go into solution. Such a finely divided and amalgamated state is certain to exist inside the tube mill during the amalgamation period when it is subjected to the grinding action of the pebbles, and it seems quite likely that a portion of the mercury would be dissolved. In any case it is well known that some compounds of mercury are readily soluble in ordinary cyanide solutions and it is not at all unlikely that some such compounds are formed during the amalgamation period, so that it seems reasonable to assume that there would be some mercury in the solution.

If this is agreed upon it is easy to see why lead salts are not necessary in subsequent cyanide treatment, for the mercury would decompose the soluble sulphides precipitating HgS. In addition, the double cyanide of mercury, $K_2Hg(CN)_4$, formed is an active solvent of silver and might assist in recovering additional amounts of it.

While it has been stated that no lime is added to the tube mill during the amalgamation period, the fact that mill solutions are used makes it necessary that lime in solution be present, at least at the initial period, though it is conceivable that it would be destroyed soon after agitation had been started.

Other Elements in Solution

In addition to the mercury there are elements in the ore, such as nickel, cobalt, manganese, sulphur, and arsenic, which would enter solution. This presents an opportunity for all sorts of chemical reactions to take place which would be exceedingly difficult to follow. The well known affinity of mercury for sulphur would account for its removal from solution and it seems likely that the other elements would be precipitated in some form at some stage of treatment. It is only reasonable to expect that the solution of the metallic elements as cyanides and their consequent transformation into other forms would act as reducers to the solution, robbing them of some of the oxygen which would otherwise be available and retarding the dissolution of silver.

Solutions Not Clear

A peculiarity of the solutions used in this treatment is that they contain quantities of a brownish-black precipitate floating in them. This precipitate is not noticeable until the solutions enter the precipitation box where so much of it is liberated that it obscures the zinc. In spite of this condition, which would apparently be fatal to good precipitation, the results are good, as shown by the solution assays already given, and the action in the zinc box is lively and normal, shown by the evolution of gas.

The floating precipitate is light in weight and does not remain on the zinc to any large extent, but does settle in the sump tank, an analysis of it showing that it contains practically all the elements mentioned as existing in the ore, together with portions of zinc and mercury.

The zinc in the zinc box does not show much effect of mercury, which has the property of amalgamating with the zinc and causing it to break up into a soft mass of short, amalgamated zinc. There may be some slight indication of it, but not enough to account for the presence of any considerable quantity of mercury in the solution * * * *

Enameled Steel Signs for Mine Signals

Enameled-steel signs designed to be practically indestructible under the most severe underground or surface conditions at mines are being marketed by J. W. Stonehouse, 907 Eighteenth St., Denver, Colo.

From the standpoint of safety as well as economy it is highly desirable that the hoisting signal code and other important information should be in permanent legible form. Signs of paper, cloth, or even of wood, cannot be said to possess the quality of permanency and for this reason are being displaced by the enameled sign, which is made by fusing pure imported enamels on a sheet of charcoal-rolled steel under high heat.

Among the important mines using these signs may be mentioned the following: Stratton's Independence, Vindicator Consolidated, Cresson Consolidated, Golden Cycle and other gold mines of the Cripple Creek district, Colorado; Copper Queen Consolidated, Calumet & Arizona, Shattuck-Arizona, United Verde, Old Dominion, Arizona Copper, Ray Consolidated, Detroit Copper, Inspiration Copper and other large copper mines as well as the Tom Reed and Goldroad gold mines in Arizona. The Portland Gold Mining Co., Victor, Colo., is to install the "Indestructible" signs as soon as the present equipment needs replacing.

Mechanical Efficiency in Crushing

By Algernon Del Mar*

In comparing crushing machines conditions must be, as nearly as possible, the same for each machine under test, and proper credit must be given to the work already performed on the rock. A system of comparison is worked out using reciprocals of diameters crushed to as an index of work done and this system is compared with Stadler's method of reduction of volume. An allowance for inaccuracies is made, as no system is absolutely correct.

*Mining engineer, Los Angeles, Calif.

To make a comparison of the amounts of work done by various machines there are certain exact figures which must be known. Clearly these include the sizes of the particles before and after the rock goes to the machine, and also the number of tons crushed per unit of time and the amount of power consumed in doing this work.

Necessity for Similar Conditions

When a rock breaker or any other crusher precedes the machine under consideration the work done by the preliminary crusher must be taken into account. For example, it would not be fair to consider the amount of work done by a machine that fed a 2-in. product with one fed a ½-in. product, for more work has been done on the latter than on the former before going to the respective machines; nor to compare the work done by a stamp mill having old shoes and dies with one which has new ones unless the records extend over enough time for an interchange of old and new wearing parts.

As pointed out by some writers, it is not possible to compare the amount of work done by a machine on one material with the work done by another machine on a different material, for the physical characteristics of ores are so different that no comparison is possible. Neither is it possible to gage the actual efficiency of any machine on a variety of ores unless we know the unit efficiency of each ore. This would be an endless job, for even with the ore from one mine, different pieces require different amounts of work to break a unit volume to some other volume. It may be possible, though, to compare the work done by different machines on the same ore, particularly when the ore has been delivered to the two machines at about the same size. The facts and calculations set forth may prove to be a new aspect of milling to some operators, in which case it is hoped it will stimulate endeavors along this line of thought just as A. W. Warwick's paper[1] has been indirectly responsible for this extension of Stadler's work.

Law of Crushing According to Rittinger and Richards

The theory of crushing as propounded by Rittinger is that the work required for crushing is proportional to the reduction in diameter. Richards[2] says the work done in crushing is proportional to the surface exposed in crushing. As the surface exposed is proportional to the reduction in diameter, both statements are identical, or the same idea may be stated thus: "The work required to crush rock is very nearly proportional to the reciprocals of the diameters crushed to." The reciprocal of ½ is 2, of ⅛ is 8, of $\frac{1}{32}$ is 32.

Allowance for Inaccuracies

That the law is not exact is mainly due to the fact that the amount of ore crushed by a given amount of power often depends upon the size of the particles being crushed and this is particularly true of the finer meshes where an approach is made to the colloidal state.

Just what percentage should be allowed to cover inaccuracies in the calculation is difficult to fix, but from an example given herein I should think 5% would be sufficient; therefore, if calculations come within 5% both machines may be considered of the same efficiency. It will be shown that this difference is entirely due to the inability of screens to measure accurately the broken rock, and to judge of the mean sizes of particles remaining on the coarsest and passing the finest mesh used.

In Table I the size of the meshes from two to 20 in the Tyler market grade of wire cloth is calculated from the size of the wire, from 20 to 200 mesh in their new standard testing sieves. The sizes of the Ludlow-Saylor screens are all calculated from the size of the wire. The last column is the average size of the grains in each class as determined by Richards.

Since the Tyler company has abandoned the use of gage numbers and uses only the diameter of the wire, the sizes as given in Table I for the brass-wire screens, are the same as for the steel-wire mill screens. The Ludlow-Saylor Co., on the contrary, uses the Old English gage for the brass-wire and the Washburn & Moen gage for the steel screens; the difference in size of openings for market grades is shown in Table II.

TABLE I—APERTURE SIZES OF BRASS WIRE LABORATORY SCREEN

Mesh	Size aperture in inches				Richards' average grain size, in.
	Tyler	De Kalb	Inst. M. & M.	Ludlow-Saylor	
2	0.437	0.4346	.....	0.435	.....
3	0.279	.....	.....	0.275	0.283
4	0.203	0.2007	.....	0.201	.....
5	0.159	.....	0.100	0.160	0.1548
6	0.132	.....	.....	0.132	.....
8	0.097	0.0952	0.095	0.095	0.1012
10	0.075	0.0728	0.05	0.073	0.0724
12	0.060	0.0528	0.0416	0.058	0.0568
14	0.051	.....	.....	0.048	0.04948
16	0.0445	0.0417	0.0312	0.042	0.0429
18	0.0386	.....	.....	0.0368	0.03716
20	0.034	0.0334	0.025	0.0335	0.03287
24	0.0267	0.0278	0.02	0.0279	0.02614
30	0.0198	0.0210	0.0166	0.021	0.01852
35	.....	.....	0.0142	.....	.....
40	0.0150	0.0147	0.0125	0.0147	0.01531
50	0.0110	0.0108	0.01	0.0110	0.01236
60	0.0087	0.0091	0.0083	0.0091	0.00948
70	0.0073	0.0074	0.0071	0.0078	.....
80	0.0068	0.0067	0.0062	0.00675	0.00677
90	0.0059	0.0061	.....	0.00611	.....
100	0.0055	0.0054	0.005	0.0055	0.00527
110	0.00484	.....	.....	0.00484	.....
120	0.00433	0.0043	.....	0.0043	0.00468
130	0.00409	.....	.....	0.00409	.....
140	0.00394	.....	.....	0.00394	.....
150	0.00367	0.0033	0.0033	0.00367	.....
160	0.00345	.....	.....	0.00345	.....
170	0.00328	.....	.....	0.00328	.....
180	0.00315	.....	.....	0.00315	.....
190	0.00306	.....	.....	0.00306	.....
200	0.0030	.....	0.0025	0.00300	.....

Determination of Relative Diameters of Pulp Grains

It may be well to consider the laws here set forth a little more closely in order to make the idea clearer. The work done in crushing is proportional to the surface exposed in crushing. If we

[1] "Mining World," July 30, 1910.
[2] "Ore Dressing," Vol. I, p. 3050.

start with an inch cube the surface will be 6 sq.in.; if now we cut this cube into ½-in. cubes we have 12 sq.in. of surface; if we cut the cube into ⅛-in. cubes we have 48 sq.in. exposed. In thus breaking up the cubes in the proportions of 6: 12: 48 or 1: 2: 8, we have reduced the diameters in the proportion of 1: ½: ⅛, or if we use the reciprocals of the diameters; of 1: 1, as ½: 2, as ⅛: 8, so that all three methods are identical.

The problem then becomes the mathematical one of determining the relative diameters of the grains of pulp before and after passing through the machine under consideration. The first requisite is to grade the pulp by screening and to determine the average diameters in each

TABLE II—LUDLOW-SAYLOR GAGES FOR STEEL AND BRASS WIRE SCREENS

Mesh	Wire No.	Steel screen in.	Wire No.	Brass screen in.
2	8	0.338	16	0.435
3	10	0.198	17	0.275
4	12	0.145	18	0.201
5	13	0.108	19	0.160
6	14	0.087	20	0.132
8	16	0.062	22	0.095
10	18	0.053	23	0.073
12	19	0.042	24	0.058
16	22	0.025	26	0.042
20	24	0.027	28	0.0335
24	26	0.021	30	0.0279
30	28	0.0173	31	0.021
40	31	0.0115	33	0.0147

grade. To do this effectively the successive screens should vary as little as possible in size. This bars screens arranged in an arithmetical progression, so

TABLE III—THE OLDER STYLE OF TYLER STANDARD TESTING SIEVES

No. mesh's per lineal inch	Wire No. O.E.	Decimal size of wire in.	Size aperture in.	Size aperture mm.
20	28	0.0165	0.0335	0.8509
30	30	0.01375	0.0195	0.4953
40	33	0.01025	0.0147	0.3734
50	35	0.009	0.011	0.2794
60	36	0.0075	0.0091	0.2311
80	38	0.00575	0.00675	0.1714
100	40	0.0045	0.0055	0.1397
120	42	0.004	0.0043	0.1093
150	44½	0.003	0.0036	0.0914
200	47	0.002	0.003	0.0762

that for practical purposes I shall consider the sizes of the ordinary laboratory screens and the sizes of the apertures shown in Table III, as represented by the Tyler standard testing sieve which, so far as I know, is the only exact screen made. For sizes of screens coarser than 20 mesh I have adopted in this table, the figures of De Kalb, which are so close to the Tyler standard in the meshes above 20, that I am led to take his other figures. Chart *A* is a graphic illustration of the Tyler standard sieve from 20 to 200 mesh, of De Kalb's from four to 20 mesh and a comparison with the standard as adopted by the Institution of Mining and Metallurgy of London.

The feature of the I. M. M. screens is that the reciprocals of the sizes of screen aperture increase in an arithmetical progression; thus for five mesh the reciprocal is 10; for 10 mesh, 20; for 20 mesh 40; for 40 mesh, 80; for 80 mesh, 160; for 100 mesh, 200.

Mean Diameter of Grains in Feed and Discharge

To find the average size of the grains in each grade, the arithmetical mean of the sizes of the apertures in the screen used and in the next larger size must be taken. That this is not absolutely correct there can be no doubt, but it is the best that can be done. The nearer the sizes of successive screens come to each other, the less the error in approximating the average diameters of the grains in a given class.

The average size of the particles going through the finest-mesh screen used can only be approximations, but it will be found that any reasonable average will be fair alike to both machines. Chart *B* is a graphic illustration of the mean diameters of particles remaining on the indicated sieves taken from the Tyler standard and the average of many tests by Richards, as explained in "Ore Dressing." The full line labeled "De Kalb" shows the average diameters using 4, 8, 16, and 20 mesh, while the dotted line shows the average diameters using 4, 8, 16, and 20 mesh, thereby showing the difference when the successive meshes are differently situated in the scale. When

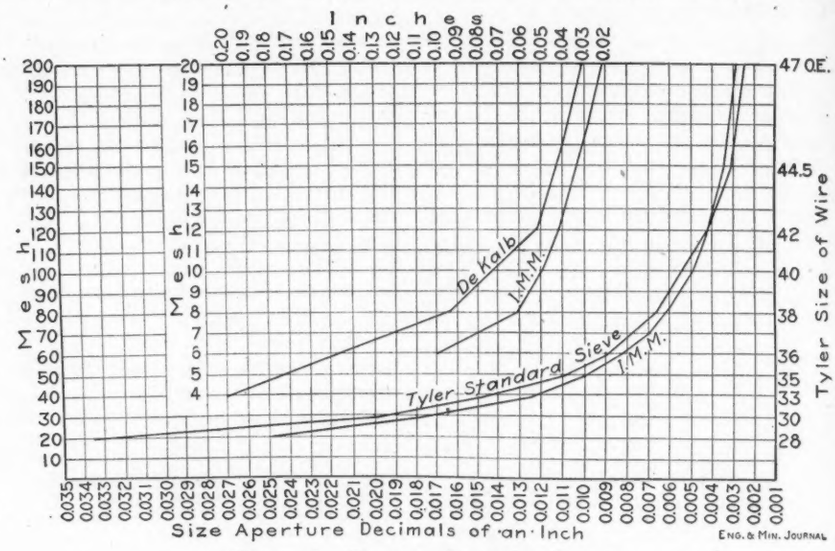


CHART A. DATA OF STANDARD SIEVES

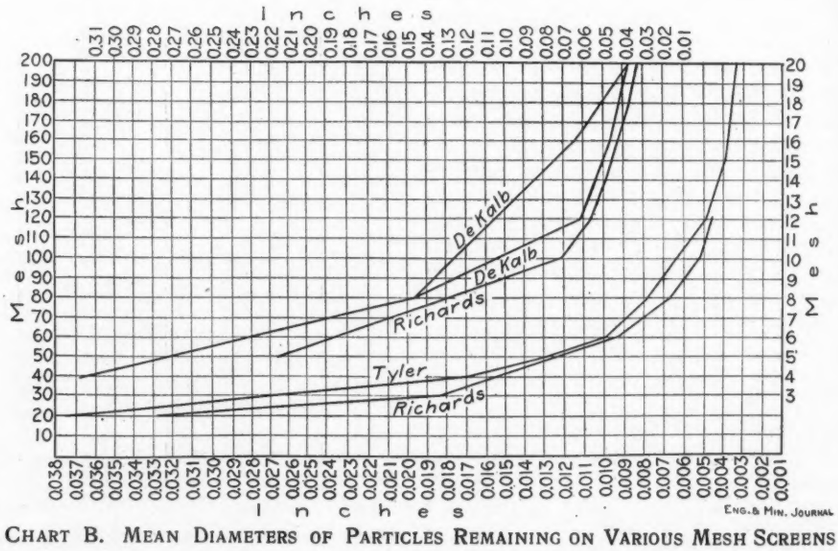


CHART B. MEAN DIAMETERS OF PARTICLES REMAINING ON VARIOUS MESH SCREENS

the relative efficiencies of two machines crushing to a certain mesh is under consideration, not the mean diameters but the size of the particle going through that mesh is required for comparison with the size of the aperture of the standard sieve.

Determining Relative Surface of Grades

"Since for any definite weight of ore the total surface area varies inversely as the diameter, the relative surface ex-

posed by each grade may be determined by dividing the weight of that grade by the average diameter of the particles of the grade." A table, as in Table IV, of the reciprocals of the size of each aperture in each grade may be made. It will then only be necessary to multiply the reciprocal by the per cent. in each grade to determine the amount of reduction performed by the machine, then having the amount of reduction done on the material before it has entered the machine and after it has been discharged from the machine a means of arriving at some comparative figures is obtained.

The first three columns in Table IV show the mesh of screen, size of aperture and the reciprocal of the size of the aperture.

The next three columns show the mesh, the mean size of the particles remaining on or going through this mesh, indicated by the plus or minus sign, and the reciprocal of the size of that grade.

TABLE IV—RECIPROCALS OF SIZES OF SCREEN APERTURES

Mesh	Diameter of opening, in.	Reciprocals	Mesh	Mean diameter of grade, in.	Reciprocals	Mean diameter of grade, in.	Reciprocals
20	0.0335	29.8	+20	0.0376	26.5	0.0376	26.5
30	0.0195	51	+30	0.0265	37.7	.....	...
40	0.0147	68	+40	0.0171	58.4	0.0241	41.4
50	0.011	91	+50	0.01285	77.7	.....	.....
60	0.0091	110	+60	0.01005	99.5	0.0119	83.6
80	0.00675	148	+80	0.00792	138	0.00792	138
100	0.0055	182	+100	0.00612	163	0.00612	163
			—100	0.0049	204	0.0049	204
120	0.0043	232.5	+120	0.0049	204	0.0049	204
			—120	0.00395	253	0.00395	253
150	0.0036	277.7	+150	0.00395	253	0.00395	253
			—150	0.0033	303	0.0033	303
200	0.003	333.3	+200	0.0033	303	0.0033	303
			—200	0.0025	400	0.0025	400

The last two columns show the size of the mean grade, leaving out the 30- and 50-mesh screens, and the reciprocal. The mean size of particles going through a 40-mesh screen when a 30-mesh screen is used is 0.0171 in. but when the next larger screen is 20 mesh then the mean size is 0.0241 in. The mean size of the plus 20 mesh is taken as the mean between 16 and 20 mesh, of the minus 200 between 200 and 250 mesh. It is not practical to measure by wire screens the sizes of particles smaller than 200 mesh. This must be done with the microscope or expressed in time of settling in still water. As ore of this fineness approaches the state called "colloidal" it will not be considered here.

Comparison of Efficiencies

A concrete example will now be considered showing how the table is used. In two mills under consideration there are regrinding machines taking pulp from a stamp mill. They are being run side by side and we want first to compare their mechanical efficiencies and then compare their mechanical efficiencies when crushing the ore to go through 120 mesh, which is as fine as is desired.

Mill No. 1 puts through 75 tons a day with an expenditure of 30 hp.; it therefore crushes 2½ tons per hp. No. 2 mill puts through the same amount of ore with 25 hp, or three tons per horsepower. The screen analyses given in Table V show the condition in each mill.

It may be that the screening analysis is submitted in the form of a screening diagram, two samples of which are shown in chart *C*.

TABLE V—SCREEN ANALYSES OF MILL MATERIAL

	Mill No. 1		Mill No. 2	
Mesh	Mill feed %	Discharge %	Mill feed %	Discharge, %
On 20.....	3.1	....	15.1	3.5
On 40.....	15.5	3.2	35.6	21.2
On 60.....	15.6	4.5	10.4	14.1
On 80.....	14.6	10.5	11.1	17.9
On 100.....	9.6	15.8	6.4	11.2
On 120.....	2.4	2.4	0.7	1.6
Thro 120....	39.2	63.6	20.7	30.5

TABLE VI—EFFICIENCY OF MILL NO. 1

Mesh	Reciprocal of average size	Feed %	Relative surface in feed	Discharge %	Relative surface in discharge
+20	26.5	3.1	82	..	....
+40	41.4	15.5	641	3.2	132
+60	83.6	15.6	1,304	4.5	376
+80	138	14.6	2,015	10.5	1,449
+100	163	9.6	1,564	15.8	2,575
+120	204	2.4	489	2.4	489
—120	253	39.2	9,917	63.6	16,090
Units of work in feed.....			16,012	Units of work in disch....	21,111
Units of work in feed.....				.....	16,012
Difference, units of work done....				.....	5,100

The left diagram shows the product of mill No. 1 plotted by simple percentages, which will be needed to find the relative efficiencies of two machines. The other diagram shows the product of mill No. 2 plotted cumulatively, which will be necessary in arriving at the efficiencies of the two machines crushing to a given mesh. There are other methods of making screen diagrams using logarithmic figures, but this degree of refinement need not bother the millman. Having all the figures, the comparison of mills Nos. 1 and 2 as to their efficiencies as crushing machines will be made. Tables VI and VII show this calculation.

Mill No. 1 has done 5100 units of reduction with an output of 2½ tons per hp. or $5100 \times 2\frac{1}{2} = 12{,}750$ units of reduction work, while mill No. 2 has done 3737 units of reduction with an output of three tons per horsepower or 11,211 units of reduction. Now if 5% is allowed

TABLE VII—EFFICIENCY OF MILL NO. 2

Mesh	Reciprocal of average size	Feed %	Relative surface in feed	Discharge %	Relative surface in discharge
+20	26.5	15.1	400	3.5	92
+40	41.4	35.6	1,473	21.2	877
+60	83.6	10.4	919	14.1	1,178
+80	138	11.1	1,532	17.9	2,470
+100	163	6.4	1,043	11.2	1,825
+120	204	0.7	143	1.6	326
—120	253	20.7	5,237	30.5	7,716
Units of work in feed.....			10,747	Units of work in disch....	14,484
Units of work in feed.....				.....	10,747
Difference units of work done....				.....	3,737

for the limit of accuracy the total is 11,771 as compared with 12,750, showing that mill No. 1 is by far the more efficient machine of the two, having done 8.7% more work than the other mill.

Using Richards' figures for the mean diameter of the particles in the different grades, except minus 120-mesh, where a conventional figure is used, the difference in the amount of work is found to be 33%; 20-mesh, 0.03287 instead of 0.0376; 40-mesh, 0.01531 instead of 0.0241; 60-mesh, 0.00948 instead of 0.0119; 80-mesh, 0.00677 instead of 0.0079; 100-mesh, 0.00527 instead of 0.00612; 120-mesh,

TABLE VIII—CUMULATIVE PERCENTAGE THROUGH MILL NO. 1

Mesh	Reciprocals	Feed %	Relative surface in feed	Discharge %	Relative surface in discharge	Difference
20	29.8	96.9	2887	100	2,980	93
40	68	81.4	5535	96.8	6,582	1047
60	110	65.8	7238	92.3	10,153	2915
80	148	51.2	7577	81.8	12,106	4629
100	182	41.6	7571	66.0	12,012	4441
120	232.5	39.2	9114	63.6	14,787	5673

0.00468 instead of 0.0049; minus 120-mesh, 0.0038 instead of 0.00395.

Efficiencies through Various Screens

It being desired to know the relative efficiencies of these two mills crushing through the various mesh screens, it is necessary to know the cumulative percentages or the amount passing each screen. This is shown in Tables VIII and IX, the reciprocals used being those of the various size screens.

If the output of these two mills was the same it would only be necessary to compare the differences for the several meshes, but No. 1 has an output of 2½ tons per hp., while No. 2 has an output

of three tons. The two results are tabulated in Table X after multiplying No. 1 by 2½ and No. 2 by three.

We now see that No. 2 has done better work than No. 1 on meshes 20, 40 and 60, but it rapidly falls behind in the meshes from 80 to 120.

TABLE IX—CUMULATIVE PERCENTAGE THROUGH MILL NO. 2

Mesh	Reciprocals	Feed %	Relative surface in feed	Discharge %	Relative surface in discharge	Difference
20	29.8	84.9	2530	96.5	2875	345
40	68	49.3	3352	75.3	5120	1768
60	110	38.9	4279	61.2	6732	2453
80	148	27.8	4114	43.3	6408	2294
100	182	21.4	3894	32.1	5842	1948
120	232.5	20.7	4812	30.5	7091	2279

TABLE X—COMPARISON OF UNIT EFFICIENCY

	Mill No. 1 E.U.	Mill No. 2 E.U.
At 20 mesh	223	1035
40 mesh	2,617	5304
60 mesh	7,287	7359
80 mesh	11,574	6882
100 mesh	11,102	5844
120 mesh	14,182	6837

Eficiency of One Mill under Different Conditions

The method herein described may be used to compare the relative mechanical efficiencies of the same mill working under different conditions, by varying the height of discharge, height of the drop, number of drops per minute or the mesh of the screen. Table XI shows an example of a mill using two different meshes of screens. The author has, however, stated that the screen analyses are of little value as the ore in the second analysis was softer than when the mill was running on the ore from which the first analysis was taken. If the ore fed to the mills was of the same average fineness in both cases, the weight of stamp, height of drop, frequency of drop, and height of discharge and other factors were the same in both cases, we would expect the relative mechanical efficiencies to be influenced only by the size of the screen aperture. As the result of the comparison here shown agrees closely with the relative costs per ton of crushing, but not closely with the power consumption, the difference must be due to the increased softness of the ore.

The relative mechanical efficiencies of the two systems are then nearly as 8: 11 in favor of the second analysis which was made with a coarser mesh than the first, showing that with this ore and arrangement of the battery system crushing to a 4-mesh screen is more economical than to a 12-mesh.

TABLE XII—COMPARISON OF SINGLE AND FIVE-STAMP UNITS

	Nissen stamp			5-stamp unit		
Mesh	Discharge %	Reciprocal	Mechanical value	Discharge %	Reciprocal	Mechanical vlaue
+40	8.56	41.4	354	5.19	41.4	214
+60	13.92	83.6	1163	13.75	83.6	1149
+80	19.73	138.0	2722	18.23	138.0	2515
+100	3.40	163.0	554	3.21	163.0	523
+200	6.39	235.2	1502	8.45	252.2	1987
—200	43.39	400	17356	48.82	400	19528
Totals			23651			25916

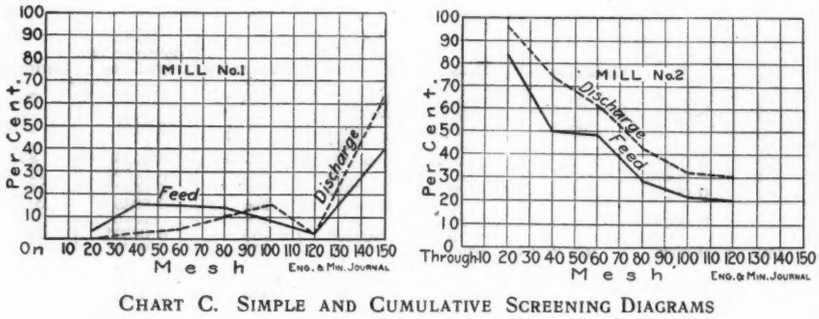


CHART C. SIMPLE AND CUMULATIVE SCREENING DIAGRAMS

TABLE XI—MILL DUTY ON TWO DIFFERENT SCREENS

Output, 6 tons per stamp, 12-mesh screen					Output 8.46 tons per stamp, 4-mesh screen				
Mesh	Mean diam. in.	Recip.	%	Value	Mesh	Mean diam. in.	Recip.	%	Value
+20	0.0376	26.5	15.6	148	+20	0.0376	26.5	15	397
+40	0.0241	41.4	28.2	1167	+30	0.0265	37.7	34	1281
+60	0.0119	83.6	18.1	1513	+50	0.01525	65.5	10	655
+80	0.00792	138.0	5.3	731	+80	0.00887	112.0	10	1120
+100	0.00612	163.0	5.4	880	+100	0.00612	163.0	3	489
+200	0.0029	344.8	6.4	2206	+150	0.00455	219.0	3	657
—200	0.0025	400.0	20.0	8000	+200	0.0033	303.0	4	1212
				14645	—200	0.0025	400.0	20	8000
									13811
14,645×6 = 87,870					13,811×8.46 = 116,841				

Comparison of Single Stamp and Five-stamp Mill

The case of a single unit and a 5-stamp unit mill working on the same ore will next be considered. The single unit is a Nissen stamp of 1659 lb., 7½-in. drop at 100 per minute crushing 5½ tons per stamp per day through a 40-mesh screen. The 5-stamp unit is a fast crushing design, 1250 lb., 7½-in. drop, 100 per minute, crushing 2.25 tons per stamp per day.

The amount of energy developed by a falling body depends upon the weight, all the other factors being constant, and the amount of rock crushed by a falling body depends upon the amount of energy developed by the falling body, all the other factors being equal, but the two mills to be considered differ not only in the weight of the stamps but also in the shape and size of the mortar and the condition of the screening surfaces. Table XII shows the figures for determining the comparative mechanical efficiencies.

The Nissen stamp has done 23,651 units of reduction with an output of 5½ tons and an estimated expenditure of 4.44 hp. or

$$\frac{23{,}651 \times 5\frac{1}{2}}{4.44} = 29{,}200 \textit{ units of reduction}$$

while the 5-stamp mill has an output of 2.25 tons with 3.36 estimated hp., or

$$\frac{25{,}916 \times 2\frac{1}{4}}{3.36} = 17{,}300 \textit{ units of reduction}$$

The mechanical efficiencies are then as 1: 0.59 in favor of the Nissen stamp. The compiler of the figures stated[3] that the power consumption was 50% less for the Nissen stamp. The above figures more than bear this out.

Theory of Crushing

The theory of crushing so far outlined may be stated as follows: *The work done in crushing is proportional to the area exposed and to the power required per unit of weight.*

Having discussed the relative efficiencies of several crushing machines calculated on the basis that the amount of energy required to crush rock was proportional to the reduction in diameter or to the surface exposed, the same examples will again be analyzed but the

[3]Can. Min. Journ., XXXI, 1910.

energy required to crush rock will be considered proportional to the reduction in volume or weight or more exactly, proportional to "the volume at every stage." The figures and ideas are all taken from H. Stadler's paper[4]. The idea is to compare the two methods and to arrive, if possible, at some idea of the relative suitabilities of the methods to the problems of crushing ores.

TABLE XIII—ENERGY UNITS OF GRADES AND SCREEN APERTURES

E. U. of mean grade			E. U. of screen opening		
Mesh	In.	No.	Mesh	In.	No.
+20	0.053	13.75	20	0.034	14.65
+40	0.0245	16.1	40	0.015	18.2
+60	0.0118	19.25	60	0.0087	20.5
+80	0.0077	21	80	0.0068	21.5
+100	0.0062	22.0	100	0.0055.	22.5
+120	0.0049	22.8	120	0.00433	23.5
+200	0.0036	24.8	200	0.003	25.2
—200	0.0025	26.0			

Stadler's Method of Comparison

Stadler says: "The volumes of the particles decrease from grade to grade at the same ratio as the number of the particles (constituting in their total the volume of the unity) increases, and the product of the volumes into the number

TABLE XIV—E.U. OF MILL NO. 1

Mesh	E. U. average size	Feed %	E.U. feed	Discharge %	E.U. discharge
+20	14.2	3.1	44.0	...	....
+40	16.2	15.5	251.1	3.2	51.8
+60	19.2	15.6	299.6	4.5	86.4
+80	21.0	14.6	306.6	10.5	220.5
+100	22.0	9.6	211.2	15.8	347.6
+120	22.8	2.4	54.7	2.4	54.7
—120	24.0	39.2	940.0	63.6	1526.4
Totals	.....	.....	2108.0		2287.4

of the particles of the grade is therefore, constant for each grade. As in conformity to the above law, the amount of energy absorbed is proportional to the volume of the body to be crushed, it fol-

TABLE XV—E.U. OF MILL NO. 2

Mesh	E.U. Average size	Feed %	E.U. Feed	Discharge %	E.U. discharge
+20	14.2	15.1	214.4	3.5	49.7
+40	16.2	35.6	576.7	21.2	342.4
+60	19.2	10.4	199.6	14.1	270.7
+80	21.0	11.1	233.1	17.9	375.9
+100	22.0	6.4	140.8	11.2	246.4
+120	22.8	0.7	15.9	1.6	36.4
—120	24.0	20.7	496.8	30.5	732.0
Totals	.....	.....	1877.3		2053.5

lows again also that the total energy required for reducing the weight of the unit is constant for each grade."

"The ordinal numbers of any arithmetical progression given to these grades represent consequently the relative values of the energy which has to be spent upon producing the respective grade from the initial unit, or the mechanical value of the grade."

"For obtaining the mechanical value of mixed sands, we need only to multiply the percentages of the gradings by the number of the energy units of the respective grade and add the products. This possibility of having the gradings of pulps condensed and expressed in one representative figure proves to be of great value."

"The useful work done per unit by any crushing machine is determined by the difference between the mechanical

MECH. VALUES	SIZE INCHES	MESH INCHES
1	0.7937	3/4
2	0.63	5/8
3	0.50	1/2
4	0.3969	3/8
5	0.315	5/16
6	0.250	1/4
7	0.1985	3.5
8	0.1575	4
9	0.125.	6
10	0.09922	8
11	0.07875	10

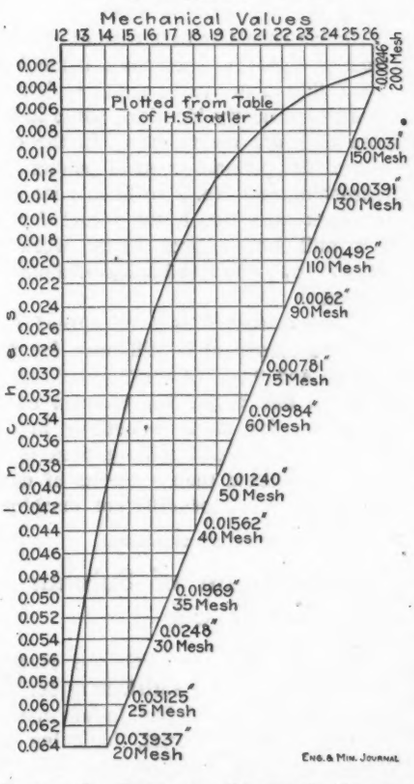


Chart D. Graph of Stadler's Energy Units

values of the samples, taken at the inlet and the discharge of the machines, and for obtaining the total work done this difference has to be multiplied by the tonnage dealt with."

"The relative mechanical efficiency is the value obtained by dividing the total work done by the unit energy (for instance horsepower):

$$\textit{Relat. Mech. Efficiency} = \frac{\textit{Tonnage} \times \textit{work done per unit in E. U.''}}{\textit{Unit of energy (hp.)}}$$

To many Mr. Stadler's method of arriving at the formula he adopts is a closed book, likewise the working of the equation N (the energy number of the grade) $= -10 \log S$. I propose to do my best to explain both. Let

K = Coeff. of molecular resistance per unit area.

F = Area of fracture

f = Force to cause fracture. Then

$f = KF$.

The distance through which the crushing force acts is proportional to the diameter of the piece, just before crushing. That is distance $= Kd$, where K is a constant and d the diameter of the particle to be crushed.

TABLE XVI—SCREEN EFFICIENCY OF MILL NO. 1

M'h	E.U.	Feed %	E.U. feed	Discharge %	E.U. discharge	Difference
20	14.65	96.9	1423	100	1465	42
40	18.2	81.4	1481	96.8	1761	280
60	20.5	65.4	134	92.3	1892	552
80	21.5	51.2	1100	81.8	1758	658
100	22.5	41.6	936	66.0	1485	549
120	23.5	39.2	921	63.6	1501	780

The work is the product of the force, distance and number P, of p particles to be crushed, = constant $\times F \times d \times P$.

Suppose we divide an initial volume of unity successively into half, quarter, eighth, etc. Thus

Volume each part.....	1	1/2	1/4	1/8	$1/P$
Number of parts.....	1	2	4	8	P
Total volume.....	1	1	1	1	$P \times 1/P$
Energy at each grade (by assumption)....	1	1	1	1	1
Total energy.....	0	1	2	3	N
Total energy.....	0	1	2	3	$\log P$
					0.301

$$= \frac{\log P}{\log 2} \therefore N \times \log 2 = \log P \text{ and } 2^N = P$$

The total energy is the summation of the energy of preceding steps.

The answer to the formula $N = -10 \log S$, where N is the energy number and

TABLE XVII—SCREEN EFFICIENCY OF MILL NO. 2

M'h	E.U.	Feed %	E.U. feed	Discharge %	E.U. discharge	Difference
20	14.65	84.9	1243	96.5	1413	170
40	18.2	49.3	897	75.3	1370	473
60	20.5	38.9	797	61.2	1254	457
80	21.5	27.8	597	43.3	927	330
100	22.5	21.4	481	32.1	722	241
120	23.5	20.7	486	30.5	716	230

S the size of mesh aperture may be worked out as follows:

Suppose the mesh aperture is 0.125 then the formula becomes

$$N = -10 \log 0.125.$$
$$(\log 0.125 = -1 + 0.09691 = -0.90309)$$
$$N = -10 \times 0.90309 = 9.03, \text{ or } N = 9$$

Energy Unit Curve

Chart D is an attempt to plot the Stadler energy-unit curve so that the numbers corresponding to a given size of screen aperture may be found without calculation. It is a very near approximation. As the figure taken to represent the mean size of particles going through

[4]Trans. I. M. M. Vol. XIX, 1909-1910.

a screen is an approximation, the diagram will give figures close enough for practical working conditions.

Referring to the diagram the numerals on the top beginning at 12 and ending with 26 are the figures representing the energy units for these lines. If it is desired to find the energy unit (E. U.) corresponding to a screen with aperture of say 0.028 in., find 0.028 in the left-hand column and follow this line to the right until it strikes the curve. This will be about half way between 15 and 16 so the E. U. for this screen will be 15½. Table XIII shows the E. U. of the mean grades of particles passing through Tyler screens and the E. U. of the size of opening in the respective grades. It will be seen that for the smaller meshes the value of E. U. of the mean grade departs considerably from the E. U. value of size of screen opening.

TABLE XVIII—COMPARATIVE EFFICIENCY FOR EACH MESH

Mesh	No. 1	No. 2
20	105 E.U.	510 E.U.
40	700	1419
60	1380	1471
80	1645	990
100	1372	723
120	1950	690

Comparison of Two Regrinding Mills

The first example, that of the two regrinding machines using the volume method, is worked out in Tables XIV and XV. For mill No. 1, this difference is 179 E. U. As the work done was 2½ tons per hp., this multiplied by 2½ will equal 447 E. U. For mill No. 2, the difference is 177.2. As the work done was three tons per horsepower, this multiplied by three equals 531 E. U. The work done by mill No. 2 is therefore 18% more than that done by mill No. 1, a direct contradiction of the relative efficiencies obtained by the reduction-in-diameter method.

TABLE XIX—COMPARISON OF SINGLE AND FIVE-STAMP UNITS

	Nissen stamp		5-stamp mill		
Mesh	E.U. average size	Discharge %	E.U. discharge	Discharge %	E.U. discharge
+40	16.2	8.56	138.6	5.19	84.0
+60	19.2	13.92	267.2	12.75	264.0
+80	21.0	19.73	414.3	18.23	382.8
+100	22.0	3.4	74.8	3.21	70.6
+200	23.7	6.39	151.5	8.45	200.2
−200	26.0	43.39	1128.4	48.82	1269.3
Totals	.....	.....	2174.8		2270.9

The relative advantages of the two mills crushing to the respective meshes, shown at Tables XVI and XVII, are calculated. Multiplying the difference for mill No. 1 by 2½ and that of mill No. 2 by three, we have the figures shown in Table XVIII, of efficiency for each mesh. This shows that for meshes 20, 40 and 60, No. 2 mill is superior to No. 1, and for meshes 80, 100 and 120, mill No. 1 is superior to mill No. 2. These are the same results obtained in the example using the reduction of diameters.

Comparison of Single and Five-stamp Units.

Table XIX shows the case of the Nissen stamps working in competition with the 5-stamp unit battery. The Nissen stamp has crushed 5½ tons with an estimated horsepower of 4.44 or

$$\frac{2175 \times 5\frac{1}{2}}{4.44} = 26.94$$

while the 5-stamp unit has crushed 2¼ tons with 3.36 hp. or

$$\frac{2271 \times 2\frac{1}{4}}{3.36} = 15.2$$

The two mills then have done work in the ratio of 1:0.56, nearly the exact ratio found by the previous calculation, using the reduction by diameter.

Having considered the case of crushing from an impartial standpoint, it has been found that in two cases under review the results are nearly identical, while in one case they are the reverse. In the case where the volume method shows the recrushing mill No. 2 to have done better work than No. 1, the actual fact is that mill No. 1 does better work as shown by the reduction-of-diameter method.

I believe that it will be agreed that Stadler's statement is still open for discussion and those who will contribute to clear up this perplexing problem ought to do so, for there is nothing in the domain of practical milling than is of more importance than a means of comparing the work of different machines.

Determination of Sulphur in Oil

The only method which the Bureau of Mines has found satisfactory for the determination of sulphur in all classes of combustible material, including all grades of liquid fuel, is combustion in a bomb with pure oxygen under a pressure of 30 to 40 atmospheres (*Tech. Paper* 26, U. S. Bureau of Mines). The method is described as follows:

From 0.7 to 1.0 gram of the sample is burned in a calorimetric bomb containing 10 c.c. of water, and oxygen under a pressure of 30 atmospheres. A lower pressure sometimes gives inaccurate results. If the sample contains more than 3% sulphur the bomb is allowed to stand in its water bath for 15 min. after ignition of the charge. In case the sulphur content is as high as 5%, oxygen under 40 atmospheres pressure is used. With these high pressures in a Berthelot bomb of 500 c.c. to 600 c.c. capacity repeated trials have failed to show even traces of carbon monoxide or sulphur dioxide. If a smaller bomb of about 175 c.c. capacity, such as the Peters or Kröker, is used, incomplete combustion from a lack of oxygen may result, if too large a sample be taken.

In this connection it is stated that one gram of a mixture of pyrite and coal, the mixture containing 25% of sulphur, was burned in a bomb under a pressure of 18 atmospheres. Upon opening the bomb the odor of SO_2 was noticeable. With a pressure of 30 atmospheres the sulphur content was 0.2% lower than that determined by the Eschka method. The combustion would have been complete if a pressure of 40 atmospheres had been used.

After cooling—15 min. are usually enough—the bomb is opened, and its contents are washed into a beaker. If the bomb has a lead washer, 5 c.c. of a saturated solution of sodium carbonate is added, the contents are heated to the boiling point, boiled for 10 min., and are then filtered. This operation is necessary to decompose any lead sulphate from the washer. The united washings are then filtered, acidified with hydrochloric acid, boiled to expel all carbonic acid, and the sulphuric-acid content is determined in the usual way with barium chloride.

Gravimetric determination is preferred to volumetric, because the nitrogen contained in the air originally in the bomb is oxidized in part to nitroacids, which cause a small error if the volumetric determination alone is used. The sulphur content of any combustible material, from light gasolines weighed in a tared gelatin capsule to solid bitumens and cokes, can be readily determined by this method.

This method of burning in a bomb is accurate, practicable, and rapid, and is recommended in preference to all of the other methods described. The calorimetric determination, if desired, can be made at the same time.

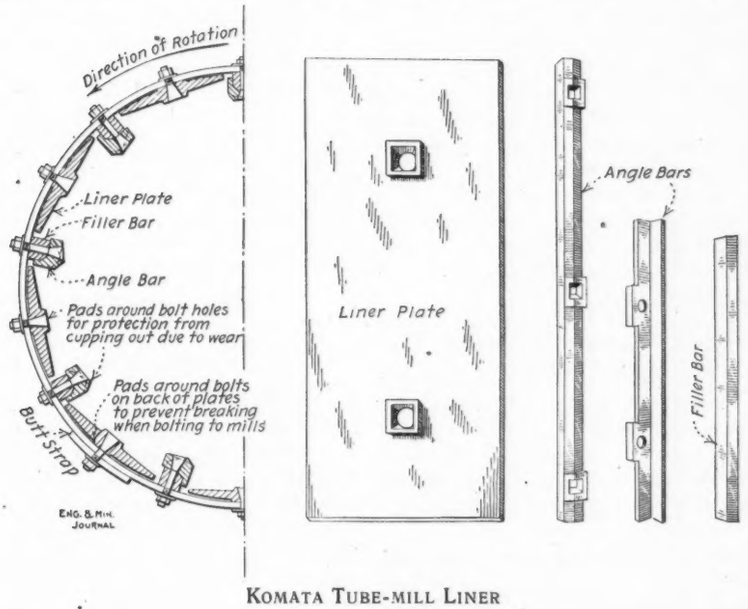
In regard to other methods, ignition in pure oxygen at atmospheric pressure, as recommended by Hempel, will sometimes give low results, owing to incomplete oxidation. Burning in an organic combustion train is tedious and requires constant supervision from a trained chemist, but is accurate. Burning in a lamp in atmospheric oxygen is applicable to burning oils, but not to gaseous oils or heavy residues.

There are at present 2145 coal-cutting machines in operation in British collieries, says *Engineering*. The majority of them are worked by compressed air.

Komata Tube Mill Liner

The Komata tube-mill liner is a metal liner consisting of a series of plates and lifting bars, which was first introduced in New Zealand at the Komata Reef mine. It has been in use in New Zealand for the last five years and has replaced the silex, honeycomb and other forms of liners. It is now being used in mills in the Goldfield and Tonopah districts of Nevada and other parts of this country.

The angle bars, which form the ribs of the liners, are of "Stag" brand manganese steel, as a tough, unbreakable metal is required. Liner plates of the same metal are also usually recommended, as long wear, and what is more important, no breakage is thus secured. However, the situation of the user's plant and local conditions often make it advisable to have the liner plates of either semi-steel, white, gray or hematite iron. In this case the manufacturers have the plates made at a local foundry and shipped direct, thus saving the operator the cost of freight.


Direction of Rotation
Liner Plate
Filler Bar
Angle Bar
Pads around bolt holes for protection from cupping out due to wear
Pads around bolts on back of plates to prevent breaking when bolting to mills
Butt Strap
ENG. & MIN. JOURNAL
Liner Plate
Angle Bars
Filler Bar

KOMATA TUBE-MILL LINER

The filler bars, which are placed underneath the angle bars, are not exposed to wear, therefore are of soft cast iron. The several pieces of the liner are fastened to the shell of the mill by means of square-headed tapered bolts, so that even though worn extremely thin they are held in place.

To prevent the liner from cupping around the bolt-holes, raised bosses are placed on the casting around each hole. Also when cast-iron plates are used, bosses ⅛ in. high are placed on the under side around each bolt hole, the object being to keep the liner from fitting close against the shell of the mill, thus avoiding danger of breaking when bolts are tightened. The pulp soon gets behind the plate and makes a backing for it. The ribs, or angle bars, are spaced about 18 or 20 in. apart, according to the diameter of the mill. Wicking or oakum is used around bolts to seal from leaks. The joints are staggered with the joints of the liner plates to prevent the forming of grooves.

The points of merit claimed for this liner are: (1) It gives a maximum area of mill and therefore increased capacity; (2) absence of slipping of pebbles on the liner results in prolonged life of the liner, the prevention of flattening of the pebbles and the avoidance of much waste power; (3) by reason of the cascading action of the pebbles, their spherical shape is maintained; this great commotion and rolling action of the pebbles produces a greatly increased grinding action; (4) the consumption of pebbles or flints and the amount of power required per ton of sand ground are small; (5) the metal is distributed to give the greatest amount of life and the least amount of scrap when worn out; (6) it alters but slightly as regards thickness and shape, which means constant peripheral speed on the inside of the liners and uniform efficiency; (7) it is easily and quickly installed and repaired; (8) it can be cast at local foundries of semi-steel, white, gray or hematite iron.

The inventor and patentee of this liner is F. C. Brown, who has granted the sole manufacturing and selling rights in the United States to the Edgar Allen American Manganese Steel Co., Chicago, Ill.

The chief use of lithium (*Bull.* U. S. Geol. Survey) is in storage batteries, where it is used as the carbonate. Small quantities are used for medicinal, photographic and pyrotechnic purposes.

October Operations at Goldfield Consolidated

During October, 1912, the total production of the Goldfield Consolidated Mines Co. was 30,573 tons, containing $456,779, or an average of $14.94 per ton, of which 29,782 tons was milled with an average extraction of 90.48%, and 791 tons was shipped of an average value of $20.24 per ton, the net recovery from all ore being $13.57 per ton. The total net realization was $242,163, or $7.92 per ton.

GOLDFIELD CONSOLIDATED OPERATING COSTS FOR OCTOBER, 1912

Mining, including stoping and development	$3.16
Transportation	0.07
Milling	1.93
Marketing	0.05
General expense	0.37
Bullion tax	0.04
Marketing ore	0.11
Total cost of operation	$5.73
Miscellaneous earnings	0.06
Net cost per ton	$5.67

During the month 4084 ft. of development work was performed. The total cost of mining, development, transportation, milling, office and general expense was $5.67 per ton, distributed as shown in the accompanying table.

In regard to the work in the individual mines, C. D. Keading, assistant superintendent, reports that in the Combination mine the 136 BX stope on the second level was extended and produced 505 tons of $26 ore. The 2460 stope, 450 ft. east of shaft between the third and fourth levels, was extended and produced 518 tons of $38 ore. The sill being cut on the orebody in the 414 C raise produced 276 tons of $32 ore. The 402 DX raise being run from the 492 intermediate below the fifth level, 250 ft. east of the shaft, encountered ore, and produced 88 tons of $34 ore.

In the Mohawk the 40 drift on the 150-ft. level, going north from the Sheets-Ish workings, produced 185 tons of $26 ore. The 107 X drift, driven in the hanging wall under the Sheets-Ish workings, on the 250-ft. level, encountered a body of ore which has not been opened at any other point, and produced 82 tons of $28 ore. This new orebody should produce a considerable tonnage of good grade ore. The 215 PX stope, between the first and second levels, 560 ft. northwest of the shaft, produced 500 tons of $30 ore. The southern end of the 307 stope, between the second and third levels, was extended and produced 1160 tons of $26 ore. The 490 R stope from the intermediate between the third and fourth levels, and just south of the big 354 stope, was highly productive, 1738 tons of $218 ore being extracted.

The 420 S stope, in the Clermont, between the 600- and 750-ft. levels, just south of the 413 sill, produced 814 tons

of $55 ore. This is the downward extension of the big 413 orebody, and will produce a large tonnage of excellent grade ore. The downward extension of the 510 orebody, between the 750- and 900-ft. levels, produced 443 tons of $23 ore. The 700 F and G stopes, between the 1200-ft. level of the Grizzly Bear and the 1000-ft. level of the Clermont produced 719 tons of $67 ore. The 802 stope was extended and produced 227 tons of $45 ore.

In the Jumbo No. 2, the stope carried up from the 220 drift produced 791 tons of $41 ore. A winze has been started on this oreshoot, and the south drift on the 300-ft. level is being advanced to open the downward extension of the ore.

Bullwhacker Experimental Leaching Plant

BUTTE CORRESPONDENCE

The Bullwhacker Copper Co. was organized in 1906 to develop the Bullwhacker claim in the Butte district, Montana. A shaft was sunk 400 ft. and crosscuts driven to the orebody on the 100-, 200-, 300- and 400-ft. levels. During 1906 and 1907 lessees shipped 6228 tons of ore containing 5% copper from above the 100-ft. level, and this quantity, together with the ore mined by the company, brought the production of the property during the two years to a total of about 850,000 lb. of fine copper. With the decrease in the price of copper in 1907 the mine was closed.

COMMERCIAL ORE CHIEFLY CHRYSACOLLA

The orebody occurs as an impregnation or replacement of the crushed granite contained in a fault zone 50 ft. or more in width, which traverses the eastern portion of the Bullwhacker claim. This fault fissure, which has a general north and south strike, is one of the Continental series of faults. Copper-bearing solutions have penetrated the crushed granite and clay fault-material, replacing portions of the granite, and filling cracks and cavities, also being absorbed by the clay in places. The body of the ore is chrysacolla, a copper silicate, but in addition there are small bunches of carbonates and oxides. The ore is low grade, carrying about 5% copper in the richest portions, and grading down to noncommercial ore on the outer edges. As far as the property has been developed, the highest grade of ore has been found to lie above the 100-ft. level, and practically nothing of value has been found below the 200-ft. level.

Recently lessees again began operations. Two one-compartment shafts, 125 ft. apart, were sunk to depths of 75 ft., on the western edge of the orebody. Short crosscuts were driven to the center of the deposit, and mining by glory-holes was begun. A platform was built at the bottom, upon which the ore was blasted in benches from the sides of the opening. From here, until recently, it was shoveled into buckets and hoisted, one hoist being operated by electricity and the other by compressed air piped from the Pittsmont property, adjoining the Bullwhacker on the southeast. As an improvement over this method a 45° incline shaft was recently sunk to the 75-ft. level between the vertical shafts and ore from the glory-hole is shoveled into mine cars and hoisted on the incline directly to the surface by means of a newly installed air-hoist. Thence the ore is trammed to the bins for shipment by wagon to the East Butte and Washoe smelteries.

ORE TOO SILICEOUS FOR PROFITABLE SMELTING

An average of between 30 and 40 tons of ore, assaying about 4.8% copper is being shipped daily at present. The ore is highly siliceous, carrying about 80% silica, for which reason the smelters penalize it severely. Experimenting has been going on for some time to determine a cheaper and more efficient method of ore treatment, with the result that a plant is now in the course of erection at the property for the purpose of leaching the crushed ore with sulphuric acid, and recovering the copper thus dissolved by electrolytic methods.

COPPER DISSOLVED IN SULPHURIC ACID

The framework of the new leaching mill, situated 250 ft. west of the orebody, has been completed. A crusher, a set of rolls, a trommel, and part of the solution tanks are in place, and it is calculated that operations will be begun before the first of the year. As the plant is being built largely on an experimental basis no definite plan of procedure can be given. Roughly, however, the ore is first crushed in a 9x15-in. Blake crusher, thence it passes through a set of rolls, from which it is elevated to the height of the crusher, and sized through a 10-mesh trommel, the rejected portion being conveyed back to the rolls, and thence to the trommel again. From the trommel the product is conveyed by gravity to two 5000-gal. leaching tanks containing a 10% solution of sulphuric acid. This strength has been determined upon for first experiments, and may be changed. It then undergoes mechanical agitation for from six to eight hours to bring it into solution as copper sulphate. Laboratory tests have established the fact that with agitation the ore can be brought into solution in this length of time, whereas 48 hr. is needed to perfect the leaching process in a quiet solution. The copper sulphate is then drawn off into circular electrolytic deposition tanks 10 ft. in diameter, where the copper is deposited upon a series of 16 cathode plates under current of about 3000 amperes. The company plans to treat in the neighborhood of 50 tons of ore per day at first, but as the process is perfected this quantity will be increased gradually to from 250 to 300 tons by enlarging the tank and crusher capacity.

Tin Smelting in Yunnan

It is reported from Yunnan, China, that a railway connecting the tin mines at Kochiu, with the main French line from Haiphong to Yunnanfu, at Mengtze, is to be built by a French firm (*Min. Journ.*, Nov. 16, 1912). Further, it is said that the great smelting plant at Kochiu is about to be operated for the first time. The Germans built it at the cost of a million dollars, and it has (according to the *Malay Mail*) been an elephant on the promoters' hands, having no definite supply of tin ever assured it, and being also without funds to operate even should the miners agree to furnish the supply. Now, however, an arrangement has been concluded covering both difficulties, though the Chinese who know are reticent as to the source of the capital.

Plans for resuming the survey of the West River Ry., by which the province of Yunnan will be connected with Canton via the province of Kwangsi, are about to be carried into effect.

Wells' Method of Making Nickel Salt

Recent reference has been made to Wells' patent for the extraction of nickel from matte by hydrochloric acid (ENG. AND MIN. JOURN., Dec. 7, 1912). The manufacture of nickel salt from this solution is covered by U. S. pat. No. 1,039,861, issued to H. L. Wells, of New Haven. The solution is treated with sulphuretted hydrogen to precipitate copper, and an oxidizing agent, such as black oxide of nickel, is added and the iron is precipitated in any suitable manner (for example, by adding calcium carbonate); sufficient sulphuric acid is then added to react with the chloride present, and sufficient ammonium sulphate to form nickel ammonium sulphate, which is recovered in the crystallized state. The mother-liquor may be utilized in dissolving fresh matte.

South Russian Manganese

In the first half of the year 1912, in the district of Nikopol, in the government of Ekaterinoslaff, 108,451 tons of manganese ore were produced, against 174,840 tons in the corresponding period of 1911, or 32.3% less (*Min. Journ.*, Nov. 9, 1912). There were exported from the Nikopol district 115,693 tons, or 30.7% less than in the 1911 corresponding period, by drawing on the stocks.

The Treasury Tunnel Raise

By H. Y. Russel*

The Treasury Tunnel Raise, near Red Mountain, Colo., was driven in the vein for prospecting purposes, but was subsequently to be trimmed and serve as a shaft. The total length was 930 ft.; outside dimensions 11x5 ft.; dip from 45° to 60°. Average progress was 100 ft. per month and average cost about $31.79 per ft. Difficulty was experienced from fine dirt blocking the rock chute.

*Mining engineer, 423 Guy St., Montreal, Canada.

In 1909 the Treasury Tunnel Co., operating in Ouray County, Colo., having cut a vein in their tunnel at a distance of 5500 ft. from the mouth and at a vertical distance of 1200 ft. below the apex, decided to prospect it by a raise and drifts therefrom. It was decided that the raise should follow the vein and that care should be taken to keep it straight so that it could be trimmed out for a shaft. The outside dimensions were to be 11x5 ft., the long side to be with the strike of the vein; two compartments, one 5x5 ft. in the clear for a rock chute, and the other 4x5 ft. for the ladders, slide for bucket and air pipe. The original intention was to raise 600 ft. but the ultimate slope length was 930 feet.

In order to keep the tunnel itself clear, a drift 40 ft. long was driven on the vein and the raise started in this drift about 10 ft. from the tunnel. This gave storage room for a train of cars beyond the raise, no switching being necessary in loading. The dip of the vein varied from 45° to 60° from the horizontal, and no sudden variations occurred. The dip at the start was 55° gradually flattening to 45° and then straightening to 60°. Some minor rolls occurred but they were not important.

Compressor Ran Continuously for Ventilation

The equipment used for the work consisted of a Sullivan straight-line air compressor, simple steam, compound air, 320 cu.ft. per min. air capacity; two Waugh stoping drills, size 3 C., together with one set of repair parts and a good supply of 1-in. cruciform steel. For hoisting a 5x6-in. Davis hoist driven by compressed air was used.

A 4-in. compressed air line delivered the air at the bottom of the raise. This line was 6000 ft. long, and a 2-in. pipe carried the air up the raise. This gave the only ventilation in either raise or tunnel and I may say that except when flying rock from a blast struck the air valve handle at the top of the raise, thus partly closing the valve, we had very little trouble with gas or bad air. It was necessary, however, to keep the compressor running continuously day and night.

No station was cut for the hoist which was set at the foot of the raise and remained there until the work was completed. It was placed across the drift opposite the manway and about 10 ft. therefrom. Sufficient height was left for a mule to pass under the cable. In setting the hoist enough of the floor of the drift was leveled to set two 6x6-in. timbers, the hoist was securely bolted to these and they were braced down from the roof of the drift.

A ⅝-in. flexible steel cable was used and about 400 ft. of it put on the drum to start with. As the raise got higher more cable was spliced on until finally we had altogether 1900 ft. of cable. Of this 900 ft. had to be taken on the drum and in order to allow this the flanges of the drum were extended 3 in. by bolting segments of sheet steel to the original flange. There was just enough play between the drum flanges and the foundation frames to allow this. After leaving the drum the cable entered the raise under a 20-in. sheave wheel and at the top of the raise it ran over a 12-in. snatch block which was securely hooked to a 30-lb. rail supported on stulls and fastened to them to prevent end slipping.

Round Peeled Timbers Used for Stulls

The timbering consisted of two rows of stulls, one 12 in. diam. between the manway and the chute, the other 7 or 8 in. diam. on the side of the manway. The latter supported the side of the bucket-slide and also the necessary lagging. Stulls were placed 5 ft. apart and great care was taken in placing them, particularly those between the chute and the manway. Hitches not less than 5 in. deep were cut, and in many places where the foot wall was soft or broken, hitches 20 in. deep were cut; and in all cases solid rock was reached. No head boards nor wedges were allowed. In every case the stulls had to be cut to drop tightly into the hitches and fit exactly.

Round peeled timbers, mostly white spruce, were used for stulls. Line was kept on the chute side of the stulls and errors due to varying sizes of stull timber, etc., were thrown into the manway, it being considered most important to keep the chute lining straight and smooth.

The topmost pair of stulls supported the rail to which the snatch block was attached and also a heavy bulkhead, which prevented anything falling down the manway. The chute was lined on the stulled side alone with 3-in. plank 10 and 12 in. wide, this lining being bought in 10 and 12-ft. lengths and cut in the drift to fit the occasion. The proper lengths and bevel were carefully taken with a carpenter's slide staff. The lining was spiked to the stulls with 60d. nails and was kept close to the top, the hanging wall half of the topmost panel alone being left out to allow access to the place of work.

Usually as soon as there was room for an additional pair of stulls, they were put in and the bulkhead raised. On occasions, however, when the roof was good, two or three pair of stulls were put in above the bulkhead before it was raised. Twenty feet was the greatest distance the bulkhead was ever raised at one time, and this did not occur more than twice as the vein was fairly soft.

Break Made in the Chute at 450 ft.

In raising great care was taken not to break the hanging wall. When the vein was less than 5 ft. wide the foot wall was broken. In this way it was rarely necessary to timber the back of the raise. This wall was carefully watched and when signs of slacking were noticed the manway was lagged.

The raise was put up 450 ft. without any break in the chute and for this distance the chute was always full after the round had been blasted, the rock was then gradually drawn off until it was 20 or 25 ft. below the top of the lining, leaving room for the next round.

At 450 ft. a break was made in the chute and a door was put in and the lower chute was gradually emptied until there was only about 50 ft. of rock left in it, which protected the door of the lower chute from the rock coming down. The break in the chute was made necessary by reason of the continued blocking by fine dirt. The upper chute was carried to 900 ft. and was kept full except before blasting, when 20 to 25 ft. of rock was drawn off to leave room for the round.

In hoisting lighter materials such as steels, tools and chute lining, they were placed in the bucket and securely fastened to the cable. Heavier materials such as stulls and pipe were fastened to a ring in the bottom of the bucket and were dragged up. The hoist was operated by the foreman, though one of the timbermen could usually run it when necessary.

Two Waugh stoping machines were used, two machine men being on each shift so that drilling could be started at any time. Eight or nine 5½-ft. holes was a round and the drilling time averaged about 2½ hr. When the drilling was done the machine men assisted the timbermen to cut hitches, put in the stulls and raise the bulkhead. The air pressure in the compressor room was kept between

100 and 105 lb. giving the hoist and drills from 90 to 95 lb. pressure. When the raise was 900 ft. high it took the shift less than 30 min. to climb from the bottom to the top.

Chute Blocked by Fine Dirt

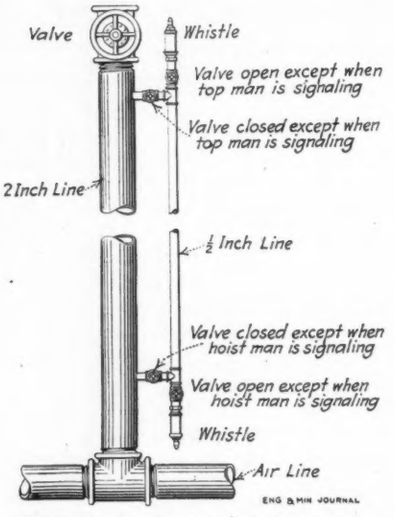
After reaching a height of 350 ft. trouble began to be experienced owing to the fine dirt sticking to the foot wall and gradually closing the chute. This dirt would in places almost close the chute for 50 or 60 ft., then a block occurred and while it was watched as carefully as possible it happened at times that open spaces 50 ft. long developed. Our original plan had been to bore holes through the lining close to the lower end of the block, make a hole in the dirt with a pointed bar and use a quarter of a stick of powder to start the block. This was not a success as owing to the tightness with which the dirt was packed the hole acted as a gun and splintered the lining without loosening the dirt. The most satisfactory method was found to be to pound the lining with an 8-lb. hammer until the blockade broke. This was slow and therefore expensive but was better than injuring the lining. It was rather terrifying to break a block with anywhere from 150 to 250 ft. of rock in the chute above and was at first done either by the foreman, or if he was away, by the superintendent, and one man. When it was found that the chute would stand the strain, however, the men were allowed to do it.

The 3-in. lining of the lower chute, which had kept in fair shape so long as the chute was drawn gradually, began to show signs of wear when the rock from above was dropped through 400 ft. of it. At times a part or even a whole panel was smashed out, but when 930 ft. was reached, the chute was still in a satisfactory condition. Several hundred feet of drifting was done at 900 ft., and the rock was passed through the chute without more than a fair amount of repair being necessary. Not more than 10 or 12 stulls broke altogether. If, however, much more work had been done, it would have been necessary to reline about 75% of the total chute, and perhaps divide the chute into 200-ft. lengths.

No Night-shift Boss Necessary

Seventeen men were employed altogether on the work. This included a foreman and also a cook and waiter in the boarding house, but did not include the clerk nor the engineer in charge. The latter took care of other company interests, but one-half of his salary, as well as the clerk's whole salary was charged to the raise. The inside crew consisted of two 8-ft. shifts; two machine men and two timbermen on each shift. As the raise got above 250 ft., one and at times two extra men were put on the day shift to look after repair work, etc. The principal reason for employing these men was to have men to replace machine men and timbermen when they quit and they were a good investment for this reason alone.

The rock was taken out of the tunnel by mules. One man on the day shift loaded the cars from the chute and drove the mule, 25 to 30 cars taking out a round. A second mule took the night shift in and out and was driven by one of the shift men. No tramming was done at night except in an emergency. No shift bosses were necessary, the foreman usually coming out early in the afternoon and going in with the night shift to see them properly started. Outside there were the blacksmith and helper and two compressor men and the cook and waiter.


Valve
Whistle
Valve open except when top man is signaling
Valve closed except when top man is signaling
2 Inch Line
½ Inch Line
Valve closed except when hoist man is signaling
Valve open except when hoist man is signaling
Whistle
Air Line
ENG & MIN JOURNAL

Whistle Signaling Arrangement

Explosives

Sixty per cent. 1⅛-in. gelatin powder was used and a "nihilte" cap. This was rather a departure from the regular custom, but was found to work most successfully. The powder was given out by the foreman after he had examined the ground, so that no more than necessary was used. The cap, which I should say was between two and three times as strong as a 6 X, gave complete combustion and little gas. The rock was broken up into small fragments, which was an important matter. The ground was easily soft enough to be broken by 40% powder, but I think it was owing to the 60% and the strong cap that we had so little trouble with ventilation. The smaller amount of powder used and the smaller holes drilled made the cost practically the same, if not less, than if 40% had been used. The fuses were cut long enough to allow the men to get to the bottom of the raise before blasting occurred.

Signaling a Difficulty

Two minor difficulties were more than usually annoying, the worst being to arrange a signaling device. Heavy telephone wire, supported on the stulls by staples and attached to gongs, was tried. This did not work at all, owing to the friction and the weight of the wire, and to the impossibility of keeping the wire taut. Electric bells were installed, using double rubber-covered wire, but the fine rock that found its way into the manway speedily cut the insulation, and it was impossible to keep the line in working order. The failure of these attempts led to orders being given that hoisting should be done at prearranged times, when no one was allowed in the manway. When the bucket reached the top, it was hung up on the stulls until it was unloaded, so that it could not be lowered. When unloaded, raps on the pipe notified the hoistman to lower. When the foreman or engineer wished to go up the raise, he went with the shift.

A whistling device, suggested by the general manager, similar to the accompanying sketch would, I think, have worked though it would have been expensive. There was always enough pressure in the 2-in. line to turn into the ½-in. line and blow the whistle. The suggestion came when the raise was nearly completed and was not tried.

The other difficulty was with rollers, several kinds being tried, but after a few days they all stopped turning and cut in half. Finally that half of the cable attached to the bucket was allowed to drag on the slide, and where it was drawn against the roof 6-in. round timbers were put in for it to run against, these timbers being replaced when necessary. The return part of the cable was held either up or down with 6-in. snatch blocks attached to the roof or to the timbers the other cable ran against. These snatch blocks were cheap and lasted from two to four weeks before cutting in half. The difficulty of returning the bucket to the bottom against the weight of the cable was overcome by loading the bucket with scrap iron.

But one accident occurred in driving the raise, and at a time when, being shorthanded, but one shift was working. The machine men reported two missed holes and returned to work next day, no one having been there meanwhile. They found that the ground had broken well, but a large block of rock was lying on the bulkhead. Without examining this rock they started to break it up with a hammer and exploded some powder, part of the missed hole's. One man was slightly injured, but the other man's eyes suffered severely. No breakages occurred in the cable, as it was carefully watched and defective parts cut out as soon as noticed.

Average Progress 100 Ft. per Month

Some of the results attained in speed were interesting. The average speed for the 930 ft. was 100 ft. per month. The

greatest monthly progress was 107 ft., which was driven between 746 and 853 ft. In fact just as good speed was made in the last 400 ft. as in the first 500 ft. The costs were practically the same.

In considering the accompanying cost sheet, it must be borne in mind that there was no work other than the raise going on; that with the same outside expense about three times as much work could have been done, and that the compressor had to run all the time for ventilation. The company's other interests made the employment of a supervising engineer necessary, and part of his salary was charged to the raise. The company also ran its own boarding house, which usually lost money, owing to the small number of men employed, and a clerk was necessary to do the ordering and check supplies in and out. The costs are given, however, as they may be of assistance to others facing a similar problem. Contracting the work was discussed but it was impossible to get men to take hold of it except at an exorbitant figure. The idea was unusual and they did not care to tackle it.

COST SHEET, TREASURY TUNNEL RAISE

(All costs except fire insurance and taxes are included)

Labor and Supplies	May		June		July		August	
	Drove 100 ft. 448-548 ft.		Drove 105 ft. 548-653 ft.		Drove 92.5 ft. 653-745.5 ft.		Drove 107.5 ft. 745.5-853 ft.	
	Total Cost	Cost per ft.	Total Cost	Cost per ft.	Total Cost	Cost per ft.	Total Cost	Cost per ft.
Machine men	$465.50	$4.65	$471.30	$4.49	$468.80	$5.06	$478.68	$4.45
Timbermen and helpers	618.70	6.19	539.79	5.14	434.01	4.70	561.87	5.24
Tramming	113.50	1.14	102.81	0.98	87.30	0.94	110.17	1.02
Explosives	118.42	1.18	142.27	1.35	76.95	0.83	83.42	0.78
Candles and oil	23.61	0.23	21.40	0.20	20.05	0.21	23.39	0.21
Timber, lumber, and timber supplies	128.74	1.29	147.02	1.40	171.28	1.85	169.07	1.57
Hauling expenses	23.72	0.24	40.45	0.39	36.14	0.40	36.19	0.33
	$1492.19	14.92	1465.13	13.95	1294.53	13.99	1462.79	13.60
Salaries and office expenses	$213.72	2.14	216.87	2.06	222.31	2.40	205.00	1.91
Foreman	158.00	1.58	154.50	1.47	159.20	1.72	162.80	1.51
Compressor men	254.00	2.54	249.00	2.38	261.40	2.83	262.60	2.44
Blacksmith and helper	121.00	1.21	169.80	1.61	217.77	2.34	129.01	1.20
Coal	1066.13	10.66	951.75	9.06	584.19	6.32	441.15	4.10
Compressor supplies	22.30	0.22	21.43	0.21	24.24	0.26	23.94	0.22
Tools and shop supplies	5.70	0.05	4.73	0.04	3.38	0.04	4.35	0.05
Maintenance or repairs	4.58	0.05	8.83	0.08	20.18	0.22	147.19	1.37
	$1845.43	18.45	1776.91	16.91	1492.67	16.13	1376.02	12.80
Employers liability							273.71	2.55
Cost of board	40.37	0.40	77.14	0.73	142.03	1.54	125.93	1.17
Total cost	3377.99	33.78	3319.18	31.61	2929.23	31.66	3238.45	30.12

For Heights Greater Than 400 Ft., 6-in. Lining Should be Used

From experience gained in this raise, I should say that for a raise up to 400 ft. 3-in. lining, spiked to 12-in. stulls, will stand. If, however, much drifting is contemplated before making the raise into a shaft, or if a greater height than 400 ft. is figured on, 6-in. lining fastened to the stulls with lag screws should be used. With this heavier lining, 1000 to 1200 ft. could, I think, be successfully driven, and the repairs would be light.

The number of times the rock chute would have to be broken and doors put in depends largely on the dip of the vein and the character of the vein filling, but 400 or 450 ft. on a 55° to 60° slope should offer no great difficulties.

The reason greater speed was not made in the Treasury raise was almost entirely due to the time it took to cut hitches, frame the stulls and put them in place. The drilling took only about 2½ hours, but five rounds per week was the best we could do, and at the same time it was economy to employ two shifts of machine men.

Two items in the cost sheet might be explained. The coal consumption in May and June included heating several buildings; this was cut out in July and August. Maintenance includes only supplies, except for August, when the cable was twice spliced at a cost of $15 per splice, and about $75 was spent on the boiler plant. Cost of board is the boarding-house deficit each month.

Cobalt in the United States in 1911

No cobalt was produced in the United States in 1911, although it is probable with an active demand that the concentrates saved in extracting lead ores at Fredericktown and at Mine LaMotte, Mo., might be made profitably productive, according to the U. S. Geological Survey; likewise deposits near Blackbird, Ida., when transportation facilities are improved. The great cobalt-producing locality is now Cobalt, Ont., and the supply for the United States is said to come entirely from there. Imports of cobalt ore and zaffer into the United States in 1911 amounted to 579,520 lb. The new alloy of cobalt and chronium, stellite, has already been described in the columns of the JOURNAL.

South African Mining Notes

JOHANNESBURG CORRESPONDENCE

The Zaaiplaats tin mine, which is working deposits of tin ore occurring in pipes in the Waterberg district of the Transvaal, made a profit of £108,364 for the year 1911-1912, £90,000 being paid in dividends. Fifteen stamps crushed 29,330 tons, assaying 3.76% metallic tin, and yielded 1647 tons of concentrates, assaying 67% Sn. Ore reserves are 24,622 tons of estimated value 3.42% Sn, with 60,000 tons of 1 to 2% tailings. The mine is suffering from a water shortage and only five stamps are now running. The orebodies are erratic and similar pipes have become unproductive in the neighboring Groenfontein mine.

The other large producer is the Rooiberg mine, working fault fissures and impregnations along joint planes in quartzite overlying granite; further to the east this mine in 1911-1912 milled 20,799 short tons for a yield of 884.58 tons of 67.9% concentrates, the assay value of the ore treated being 4.94%. Tailings amounting to 44,500 tons, assaying 2.51% Sn, are now being retreated in a new 15-stamp mill with Cornish tin-dressing appliances. Ore reserves amount to 21,300 tons, assaying 4.7% Sn. Development work appears so far to have been somewhat disappointing, as no payable ore has been met with in the lowest, the 310-ft. level. Early concentrating practice was, as may be judged by the value of tails, exceedingly poor in the case of these South African tin mines.

The Barnato brothers, who hold large interests in the Jagersfontein and De Beers mines, have acquired large interests in the Premier mine, and now concerted action between these diamond producers, with a view to regulating prices, may be looked for. The alluvial diamond areas along the Vaal River, in the neighborhood of Boshoff, in the southwest Transvaal, still continue to afford occupation to a large army of diggers. One digger recently found a 30-carat stone, which sold for £800.

Van Ryn Deep Gold Mining Co. holds 700 claims on the dip of the Van Ryn and Kleinfontein mines. There is fully developed 790,818 tons of mill ore, assaying 7.50 dwt., with 347,500 tons of 3.06 dwt. value. The new mill under construction will consist of eighty 1900-lb. stamps, with eight tube mills, 16½x6 ft. This plant is expected to crush 40,000 tons per month, and as under the new law the mill may not run on Sundays, about 20 tons per stamp per day must be crushed; room will be left for another 10 stamps. The mill will be electrically driven from purchased power. The sand plant will consist of three collecting vats and eight treatment tanks equipped with Blaisdell distributors. The slime will be treated by vacuum filters.

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

D. C. Jackling has gone to Alaska.

H. C. Hoover has returned from California.

J. Parke Channing is expected home about Dec. 20.

Frederick G. Clapp is examining oil properties at Bartlesville, Oklahoma.

John J. Penhale, of Sherbrooke, P. I., recently spent some time in New York.

Percy L. Fearn has returned to New York after a trip to South America on professional business.

Walter H. Case, of El Paso, Texas is now at Courtland, Arizona, making examinations for Eastern men.

Dr. L. D. Godshall has been appointed manager of the Tecopa Consolidated Mining Co., in Inyo County, California.

Morril B. Spaulding is now manager of the Pittsburgh district of the Crocker-Wheeler Co., with headquarters in the Oliver Building, Pittsburgh.

William Hague, managing director of the North Star Mines Co., Grass Valley, Calif., is in New York attending the annual meeting of his company.

Hon. Mr. Armstrong, minister of mines for Nova Scotia, was in Toronto, Ont., recently making inquiries concerning the mining legislation of Ontario.

John Rooke-Croowell has been appointed manager of the Cordova mine, in Hastings County, Ont. He was formerly in California and more recently in Mexico.

Colin Fraser, late of the New Zealand Geological Survey and now of London, England, has returned from a trip to British Columbia and is now in Northern Ontario.

Henry H. Armstead is leaving New York for Vera Cruz, Mexico, Dec. 19, to make an inspection of the Mexican United Co. properties, in Guanajuato, Jalisco and Tepic.

J. A. McGowan, purchasing agent for the United States Metals Refining Co., at Grasselli, Ind., severed his connections with the firm on Dec. 1. L. R. Pratt has been appointed in his place.

F. A. J. FitzGerald, formerly chief chemist of the Carborundum Co., at Niagara Falls, N. Y., spoke recently at the Franklin Institute in Philadelphia, on "Experimenting with the Electric Furnace."

William B. Dickson, for many years connected with the Carnegie Steel Co., and for several years first vice-president of the United States Steel Corporation, has been chosen president of the International Steam Pump Co., to succeed the late Benjamin Guggenheim.

At Johnstown, Penn., Dec. 5, the association of business men gave a testimonial banquet to James A. Farrell, president of the United States Steel Corporation; William H. Donner, newly elected president of the Cambria Steel Co.; Daniel Coolidge, president of the Lorain Steel Co., and Vice-President John A. Reis, of the United States Steel Corporation.

William E. Hartman has resigned his position as managing engineer of the H. Koppers Co., Chicago, manufacturer of byproduct coke ovens. Some additional changes have also been made in the organization and the list of officials is now as follows: President, H. Koppers; first vice-president, John C. McMath; second vice-president, Thomas V. Salt; chief engineer, Allan Strale; secretary and treasurer, Joseph M. Butler.

Dr. William B. Phillips, director of the Bureau of Economic Geology and Technology, University of Texas, is examining silver-lead prospects in Brewster County, Texas. On the completion of this work he is to examine the old silver and lead mines, near Nieves, Zacatecas, Mexico. This district is looking up, now that the railroad from Durango to Canitas is approaching it from the west. It will probably cross the Rio Grande, Zacatecas, at Rio Grande, and connect with the Mexican Central system, at Canitas. This will give an outlet for the Nieves ores for shipment to Aguascalientes.

OBITUARY

H. M. Ephraim, aged 30 years, and mine captain at the Helen iron mine, in the Michipicoten district, Ontario, was killed Dec. 3, by falling 150 ft. down a shaft. He was from Flint, Mich., and was a graduate of the Michigan College of Mines.

James Burke died at Reno, Nev., Dec. 1, aged 82 years. He was born in Canada, but went West at an early age and was one of the first of the California pioneers. He is said to have been the last survivor of the party led by James Marshall, who discovered gold in California.

Robert T. Hopper died at Montreal, Nov. 14, aged 54 years. He had been identified with the mining industry for 35 years, first in connection with the manufacture of portland cement, and later in the mining and production of asbestos and marble. The *Canadian Mining Journal* says: "He was a charter member of the Canadian Mining Institute, in which organization he took a keen and active interest. That his services to the society were valued is attested by the fact that he served as a member of Council for no less than nine terms, a record so far unequalled. A man of warm sympathies, generous-hearted, broad-minded, loyal and upright in character, the death of 'Bob' Hopper, as he was affectionately termed among his intimates, is a sad loss. He fought an uphill fight against odds for 30 years. That having achieved success he should not live to enjoy its fruits seems hard, yet he had the consciousness that he left behind him the record of a clean and useful life."

Societies and Technical Schools

Canadian Mining Institute, Ottawa Branch—At a meeting held in Ottawa, Dec. 4 a branch of the Canadian Mining Institute was organized. The following officials were elected. Chairman, W. R. Askwith; secretary, George L. Burland; executive committee, J. McLeish, G. C. McKenzie; Dr. A. D. Cairns, Robert Harvey and W. J. Dick. Dr. A. E. Barlow, president, and H. Mortimer-Lamb secretary of the Canadian Institute, gave addresses on the work and aims of the organization.

Austrian Congress of Mines and Metallurgy—The Allgemeiner Bergmannstag, held at Vienna, Sept. 16 to 20, was the eighth of these international congresses since their inauguration by Dr. Ferdinand Stamm, in 1858. The papers presented bore on the subjects of electricity in mines; power production by large central stations; rescue work in mine disasters; sand filling with hydraulic transportation; wireless telephony in mines; diamond drilling; iron blast-furnace gas purification, and briquetting processes for iron ores.

West Virginia Mining Institute—The meeting, held at Parkersburg, W. Va., Dec. 10 and 11, was largely attended, more than 150 members being present. The meeting was the occasion for a number of demonstrations showing what progress has been made during the past year in lessening the dangers in coal mines and what inventions have been made to minimize disasters.

American Association of Manufacturers of Sand-lime Products—The ninth annual convention of this organization was held on Dec. 3 and 4 at the King Edward Hotel, Toronto. President S. O. Goho, of Harrisburg, Penn., occupied the chair. There was a large attendance. Among the technical papers presented were "The Results of Testing Sand-lime Brick," by Warren E. Emley, of the U. S. Bureau of Standards, Pittsburgh; "The Present Condition of the Industry," by W. H. Crane. The delegate made an inspection of the local plants of the Toronto Sand-lime Brick Co. and the Toronto & Harbor Brick Co., and declared the bricks equal to those manufactured in the large American cities. The election of officers resulted as follows: President, S. O. Goho, Harrisburg, Penn.; vice-president, F. B. Allan, Toronto, Ont.; secretary, W. G. Plummer, Jr., Buffalo, N. Y.; treasurer, John L. Jackson, Saginaw, Mich. Harrisburg, Penn., was chosen as next place of meeting.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Dec. 4—W. H. Storms, state mineralogist, has submitted to the state controller and board of control an estimate of the monetary requirements of the State Mining Bureau for the two years beginning July 1, 1913. The estimate totals $135,000 and covers the following general and special items: Salary of state mineralogist and support of the bureau, including salaries of attachés, $46,000; preparation of general report, employing six fieldmen, $39,000; for special work on the Mother Lode, iron deposits, metallurgy, mining methods, ancient channels, $15,000; printing, $10,000; Panama-Pacific Exposition, $25,000. The work contemplated embraces features of special importance and of general interest to the mining industry of the state. The estimates for field work are not only conservative, but so low that it will be necessary to practice every economy in order to complete the work to the satisfaction of the state mineralogist and to the best interests of the state. The revival of the general reports will be appreciated in every mining district in the state. These reports were issued annually from 1880 until 1890, inclusive, and were followed by three biennial reports, making a total of 13 general reports; they were abandoned in 1897. Since then the state has been dependent upon the U. S. Geological Survey and the technical mining press for records and data that should have been supplied by the State Mining Bureau under the provisions of the act creating and maintaining the bureau. The special features contemplated embrace subjects of great importance at present, and if permitted to be exploited by the appropriation to be recommended by the board of control, will no doubt be followed in the second half of the present term of the state mineralogist by other work of equal importance. Much of the work of the bureau in the last 15 years has been delayed to the extent of detracting from the value of the publications. This may be avoided. The estimate for representation of the state at the exposition is quite conservative, but sufficient to make a valuable exhibit.

Denver

Dec. 6—In November the Cripple Creek district added more than $1,000,000 to the world's store of gold. The tonnage was 3621 tons greater than October, and the bullion value somewhat less, owing to the largely increased low-grade production milled. All the small local mills were in operation through the month. The total tonnage was 79,097 with a gross value of $1,175,035.

It is reported that John F. Barnett and G. F. Bradley, of Ouray, will build a 200-ton concentrating and zinc separating plant on the site of the P. F. Walsh pyritic smeltery at Silverton. They plan to separate the concentrates of other mills, and the cyanide plant will be operated in conjunction with the separator. It is stated that the money has been raised in New York and Boston, plans have been drawn, and the company is ready to commence work. It is further announced that Dr. J. M. Pascal, chairman of the mining committee of the Silverton Commercial Club, is to erect a similar plant at Silverton early next spring under the name of the San Juan Ore Reduction Co.; J. M. McClave, of Denver, consulting engineer. Other interesting mill news is to the effect that the much talked of Edison concentrator is at last to be tried out at Georgetown, where it is said ground has been broken for a new mill to be equipped with Edison machines. It will adjoin the Pelican 200-ton mill, which is also to be utilized to a larger extent, also that the new 10-stamp mill at the Empress tunnel on Corode Mountain will be ready to run in two weeks. This plant is equipped for amalgamation and concentration.

Butte

Dec. 4—During November, Madison County led all others in the production of gold in Montana, the amount which was deposited at the U. S. Assay Office at Helena being $61,709. The amounts deposited by the other counties were as follows: Lewis & Clark, $26,515; Fergus, $21,808; Chouteau, $15,053; Ravalli, $4961; Missoula, $2592; Powell, $1508; Broadwater, $897; Park, $502; Silver Bow, $394; Granite, $376; Flathead, $198; Meagher, $196; a total of $136,709.

A consignment of 12 boxes of Montana sapphires, weighing 4069 lb., was recently shipped from the mines of the Yogo district, near Utica, in Fergus County, to the New Mines Sapphire Syndicate, London, England. These mines have been operated for several years, the stones always being sent to England to be cut before being placed upon the market at New York. The sapphire mines in the Yogo district are noted for their size and brilliancy, and two shipments per year are made.

At a sheriff's sale held at Butte, Dec. 3, T. S. Crosley, of New York, purchased the holdings of the La France Copper Co. for $100,000, acting as the representative of the newly organized La France Copper Co. The sale was held for the purpose of satisfying a judgment for $2,000,000 given to the Lincoln Trust Co. as trustees for the holders of bonds for that amount, issued in 1906, and upon which the company defaulted upon the payment of both interest and principal. The following claims were represented in the sale: Wild Pat, Lexington, Louisa, Angela, Allie Brown, Atlantic, and Wappelo, with the machinery, warehouses, and other property. Although the future plans of the new company have not yet been made public, it is probable that operations will be begun shortly at the Lexington mine, which is known to contain large shoots of zinc ore.

Salt Lake City

Dec. 4—The copper-production report for 1911, by B. S. Butler, of the U. S. Geological Survey shows that 25,632,585 tons of concentrating copper ore averaging 1.34% copper were handled by the various states. Of this total, Utah produced 5,480,370 tons of ore, from which 228,583 tons of concentrates, carrying 106,744,211 lb. copper were obtained. Utah stood second to Michigan, which handled the greatest tonnage of concentrating copper ore. Of direct-smelting copper ore, Utah produced 640,729 tons, averaging 2.55%. Regarding the history of the industry in the state, the first recorded production was in 1872. The state did not become an important producer until late in the nineties, since which time the industry has steadily grown. The total recorded production to the close of 1911 has been 797,044,788 lb., or 4.89% of the output of the United States since 1845. During 1910, Utah ranked fourth among the copper producing states, and in 1911 produced 12.97% of the output.

Negaunee, Mich.

Dec. 6—After five weeks' trial the concentrator at the American iron mine is still in the experimental stage. Several problems remain to be solved, but it is believed the idea of concentrating low-grade iron ore has been demonstrated to be entirely practical and that the undertaking will be a success. One of the unlooked for developments is the large proportion of fines (material under 2 mm.) made in crushing. The

low-grade ore as it comes from the mine is crushed to 1 in. in the gyratory-crusher plant at the shaft, where two different size crushers are in operation. After being conveyed by belt conveyor to the mill, it is crushed to 5/8 in. by rolls; this completes the crushing process. It was originally believed that the fines would constitute about 10% of the whole, but this proportion is greatly exceeded and is usually several times that amount. This concentrator, the only one in Michigan, differs materially from those on the western Mesabi range, one of the principal differences being that the American mine plant uses Richards pulsator jigs to produce the bulk of its product. The concentrator was originally intended for 500 tons capacity per day, but it is not yet known what amount it will handle, as the introduction of further changes in the flowsheet may considerably increase this figure. The addition of full jigs is contemplated. The material fed to the mill assays between 40% and 48% in iron; the concentrated product about 62%; the tails 18 or 20% iron. The water used at present varies between 2500 and 3000 gal. per min. The small lake from which the water-supply is obtained lowered only a few inches and has remained at that level. The flowsheet, although not definitely made up as to detail, contains the following: rolls, trommels, Richards pulsator jigs, Callow belt, Callow screen and Deister tables.

Deadwood, S. D.

Nov. 22—Each employee of the Homestake Mining Co. will receive in addition to December pay an amount equal to 7% of his total earnings with the company during the year 1912. The disbursement will be made on pay day in January, and will embrace every man on the December payrolls, no matter whether he has worked a year or only part of a month. The company is making this disbursement for the first time in its history, and is the direct result of the most prosperous year the company has ever had. It will mean the distribution of nearly $200,000 among the employees.

The annual report of the state mine inspector, R. L. Daugherty, for the year ended Nov. 1, 1912, shows that the production of gold in South Dakota was $8,035,598, "the largest total since this office has been established, and while the quantity of ore treated also shows an increase, the average value of the ores milled is greater than before." The largest producer, as usual, is the Homestake, with $6,596,00 recovered from 1,529,474 tons. The Golden Reward produced $323,846.78, Wasp No. 2, $308, 595.82, Mogul, $242,567.99. The total number of employees of South Dakota mining companies is given at 3808. During the year covered by the report there were but three fatalities underground and an equal number above ground. Dividends of the year include $1,310,400 by the Homestake and $85,000 by the Wasp No. 2. The inspector states the industry to be in excellent condition, and growing steadily.

Casper, Wyo

Nov. 28—Although oil springs were known to exist near the present site of Lander, in Wyoming, and were described by Captain Bonneville, in 1833, later by the Mormons, in 1847, and although the oil springs near Newcastle and on the Belle Fourche River supplied oil for lubricating purposes in the early days of Black Hills gold mining, only desultory work was done in the way of test wells drilled and small quantities of oil obtained until about three years ago, when the discovery of oil in large quantities in the Salt Creek field revived interest and activity, which now is greater than ever before in this state. At present Salt Creek field has over 100 miles of 6-in. pipeline, equipped with pumping facilities adequate for the transportation of 18,000 bbl. of oil daily, which quantity, of course, is in advance of the present production, but anticipates future production. Of this pumping capacity, the largest amount, or 13,000 bbl., is owned by the Midwest Oil Co., and the remainder by the Franco-Wyoming Oil Co. The Midwest has a storage capacity of over 500,000 bbl., while that of the other companies aggregate about 250,000 bbl., making a total storage capacity of over 750,000 bbl. The two refineries at Casper, of the Midwest company and the Franco-Wyoming company, have a total capacity of 18,000 bbl., with 160 railroad tank-cars in its service.

Seward, Alaska

Nov. 29—Practically every citizen in Seward attended a recent indignation meeting to protest against the alleged illegal actions of W. J. Lewis, special agent of the land department, who is accused of threatening homesteaders and miners with prosecution, if they did not furnish evidence to aid in the conviction of local residents on charges of cutting firewood on forest and naval reserves. The meeting was held under the auspices of the Seward Commercial Club and a committee was appointed to draw resolutions for the immediate recall of Lewis and an investigation of his conduct. Public feeling against him is exceedingly bitter.

Under the laws alleged to be unconstitutional all the land within 40 miles of Seward has been segregated from the government domain and placed in forest and naval reserves, upon which the timber may not be cut. Because the coal has been withdrawn from entry and must be imported from British Columbia at a cost of from $17 to $20 per ton, residents of Seward have made a practice of cutting the timber for firewood.

Cobalt

Dec. 7—It is stated that the Elk Lake branch of the Timiskaming & Northern Ontario Ry. will be completed to the town of Elk Lake by Christmas. As soon as the railroad is in, several shipments of ore will be made from Gowganda, where they are being held until cheaper transportation is available.

Good results are being obtained at the Mann property; two cars of high-grade ore are on hand. It has been reported that a small concentrating plant will be built in the near future. It is generally believed that the advent of the railroad will assist in opening this district, where the surface showings are regarded, by men competent to judge, as equal to or better than those at Elk Lake.

Porcupine

Dec. 7—An unfavorable turn was given the strike situation during the last week by the shooting of three strikers by Thiel detectives, who were guarding the properties. Fortunately, none of the men shot were seriously hurt. This has, however, much intensified the ill feeling existing between the Thiel men and the strikers. A carload of strike breakers *en route* for Timmins was stopped near Golden City. The car was smashed and the strike breakers driven out. Several disorderly acts of this sort have called attention to the necessity for more protection in the shape of provincial officers. Individual mines were guarded by detectives, but there were not enough policemen in the town to subdue the many acts of rowdyism which were continually taking place. Strong representations were made to the authorities in Toronto and it was decided to send a force of at least 25 provincial officers into the district.

Interest in the situation has been developed by the act of the Hollinger in swearing out summonses against about 300 of the men who went on strike, alleging a breach of the Lemieux act. This, it is stated, will be the first case of its kind under the act, and no doubt will be made a test. Five mines only, not including the Hollinger, submitted their case to a conciliation board, but the men went on strike at the Hollinger also, and left without giving due notice, thereby constituting a breach of the act. The men are liable to a fine of $10 per day for the time they are on strike. The Hollinger seems to be the key to the situation. The strikers have focused their attention upon this mine and when the strike is finally broken there, no further trouble will be experienced throughout the camp. At the Dome, no trouble has been experienced since the beginning of the strike and the property is being operated with about 250 or 300 men.

The Mining News

The Current History of Mining

Alaska

Great Northern Development Co.—It is reported that on Dec. 9, a snowslide on Copper Mountain, near Cordova, carried away seven buildings on the property of this company and it is believed that nine men were buried beneath it.

Alaska United—During October, 18,704 tons of ore was milled at the Ready Bullion mill from which $62,015 or $2.15 per ton in gold was recovered at an estimated net profit of $37,284. At the 700-Ft. Claim mill, 19,677 tons of ore was milled, from which $50,175 or $1.38 per ton was recovered, at a net profit of $24,-734.

Ebner—It is announced by Judge J. P. Winn, of Juneau, that satisfactory arrangements have been made for the opening of this mine early in the spring. This will give employment to several hundred men.

Alaska Gold Mines Co.—The first power drill has been set at work in the tunnel at the Alaska-Gastineau mines, at Sheep Creek, which will connect the Perseverance and Sheep Creek properties. The tunnel is 8x10 ft. and will be 8000 ft. long.

Reliance—Martin Hanais, of Fairbanks, has taken a lease on this property on Dome Creek and will open up from the 100-ft. shaft and make other improvements.

Rainbow—Maddocks & Roth, of Fairbanks, have purchased F. Zimmerman's interest in this property, and are making preparations for building a two-stamp mill.

Newsboy Mining Co.—The five-stamp mill, which had been removed from its former site at the mine to the head of Cherry Creek, was placed in operation, Oct. 15. The well drilled at the mill by the Star drilling outfit is expected to furnish water for the entire winter. A cleanup made after 11 days indicated a yield of $16.67 per ton. The ore is being hauled from the mine to the mill, a distance of 4000 ft., by teams. In the mine, two stopes are being worked from the west drift of the 215-ft. level. In the east drift, at a point 165 ft. from the shaft, crosscuts are being driven in an effort to pick up the vein where it is faulted. On the 315-ft. level, where nothing has been done beyond the cutting of a station, work is to be resumed at once. Louis Golden is manager.

Tolovana—The two-stamp Nissen mill on this Willow Creek property has been running steadily for the last two months. Some ore is being stoped from the 85-ft. level, but not enough to supply the mill. The deficiency is made up from the lower-grade ore left on the dump by the old Huntington mill, which was discarded a few months ago. From a new vein recently discovered on the Bedrock side of the ridge, some very rich ore was taken. The shaft is down 40 ft. on this vein, and shows it to be irregular in size and gold content.

Arizona

Gila County

Southwestern Miami—Three Star drill rigs are in operation. Hole No. 7, 1391 ft. deep and bottomed in schist, will be finished in the near future. Hole No. 9, which is on the recently acquired Prospectors' group, is 395 ft. deep and is still in schist. Hole No. 10 is 102 ft. deep and is also in schist. The assessment on the Prospectors' portion of the property is nearing completion under the charge of the original owners of the property, although the expense is being borne by the company, this being according to the stipulation of the contract of sale.

Old Dominion—The new crusher plant excavation work is progressing well and should be completed soon. A new 750-kw. turbine has been installed at the smeltery power plant and a new geared hoist will be shipped from the factory early in December for installation at the "A" shaft. The management hopes to have the new basic converters running in January.

Gibson—General Manager Henderson expects to ship six carloads of copper ore from the Summit this month as against seven carloads for November. The lessees will ship two carloads of ore as they did last month. There are two parties of lessees, one on the Pasquale and the other on the Summit vein. The ore being mined by the company is coming from the fourth level, but as soon as a shute has been finished to the sixth level, the ore from the fourth level will be dropped through to the sixth and the ground between those two levels will be worked.

Superior & Boston—The ore recently encountered continues as driving and other exploration work along the vein progresses. The east drift on the eighth level continues in the ore and the raise started from the place on that level where the ore was first encountered has been lifted 20 ft. toward the sixth level and is wholly in ore.

Miami—Extensive improvements are in progress in the way of erection of buildings and installation of equipment. The usual progress in development is being maintained. The new mine machine shops are completed and the engineering force has entered its new and thoroughly equipped offices. In the same building are the mine offices. The concrete foundation for the change house near No. 4 shaft has been finished and the new hospital building is well along in course of construction. Two churn drills and two diamond drills are being operated; a perpendicular hole is being sunk from the lowest level of the mine. Another 600-hp. boiler, the fourth, has been finished at the power plant and is now generating power.

White Metal—Rich silver ore has been found at this mine in the Apache Mountains. William Fisk and Henry Snell are interested in the property.

California

Amador County

Memphis—It was reported in July that a 12-ft. vein had been disclosed at the 50-ft. level in the shaft on this mine, south of Plymouth. The shaft will be deepened to 100 ft. The pay ore is said to be about six feet wide and will average $5 per ton. Memphis Mining Co., owner; J. A. Monteverde, president. The property is one of the old Boyson claims, and was only recently developed.

Lincoln Consolidated—The report of a strike of good ore in the extension of the 1950-ft. level of the Lincoln into Wildman ground is corroborated. The small stringer of pay ore had widened out to about eight feet, carrying free gold and sulphides. This is about 400 ft. deeper than the old workings of the Wildman, and is the only important find that has been made in the last 30 years. The present operators have developed on the theory that the Wildman payshoot would be found at depth. The ore is characteristic of the Mother Lode. W. J. McGee, of Sutter Creek, is manager. A. Noce is superintendent.

Keystone Mines—The legal contest between this corporation, which is the owner of the Keystone mine, and the former owner commonly known as the old Keystone company, has been trans-

ferred to the superior court of San Francisco. The contest concerns only the disposition of money withheld from the purchase price for the payment of receiver's certificates issued to former employees, should the certificates be held by the court not to be a lien on the property. Since the court has so decided, the receiver is seeking to recover from the money withheld from the purchase price. The suit in no way affects the title to the property nor the ownership by the Keystone Mines. The mine is being developed on a large scale, and is well equipped with machinery. C. R. Downs, of Sutter Creek is manager.

FRESNO COUNTY

Pacific Quicksilver Co.—Cinnabar claims have recently been located and purchased in the western part of the county, near the line of San Benito County, in the Mercy district. A good quality of cinnabar ore is reported to have been discovered.

INYO COUNTY

A. J. Carpenter and others, of Independence, are reopening the old Kearsarge district. There are 17 claims that are being prospected, from which samples of high-grade ore have been taken.

Southern Belle—Buildings, cars, track and whim formerly in use at this mine, near Laws, have been removed across the line into Mono County, to be reconstructed at the St. Ives mine, recently reopened.

KERN COUNTY

The Standard is building a new refinery in the Kern River field, near the Oil Center branch of the Southern Pacific R.R., east of the Standard's tank farm. The plant will be equipped for making illuminating, lubricating and other oils, gasoline and distillates, for the San Joaquin Valley market.

MONO COUNTY

St. Ives—This mine, near Laws, has been reopened by the Lone Star Mining Co., of Goldfield. The shaft will be straightened, and from the 50-ft. point will be made vertical for 125 ft. From the 125-ft. station to the bottom, a total depth of 270 ft., the shaft is inclined. It will be timbered and drifts driven on the orebodies. Under lease the mine formerly produced ore worth $15 to $30 per ton. E. E. Green is superintendent.

PLACER COUNTY

Soudan Gold Mining Co.—This is a new company, organized to develop under a purchase bond the Knoff mine, adjoining the old Hathaway, in the Ophir district. It is reported that a Beer roller mill will be installed, and electric power used for operating the mill and mine. The incorporators of the company are E. W. Wallace and Elizabeth A. Wallace, of Seattle, F. G. Beuck, of Minneapolis, C. Tilton and E. P. Stephenson, of Sacramento.

SHASTA COUNTY

Bully Hill—Work is being continued in the experimental zinc-extraction plant.

Standard Mining Co.—A suit has been brought in the Superior court to restrain the directors from selling the stock of certain shareholders, and demanding an accounting. The company has been reopening the Uncle Sam mine, formerly a large producer, and it is charged that $24,000 has been spent in conjunction with the Big Seven Consolidated Mining Co., and that only $4000 worth of improvements have been made. Some low-grade ore has been mined, it is claimed, without profit.

TRINITY COUNTY

Samuel Williams and John Clayton are building a five-stamp mill at their mine in Ames Gulch, about eight miles north of Lewiston. A large quantity of milling ore is reported, and some shipping ore also has been mined.

Trinity Dredging Co.—The new dredge is in operation on Trinity River, north of Lewiston.

TUOLUMNE COUNTY

Clio—The mine and surface equipment has been taken over by forced sale by the Ora Mining Co. The mine was reopened about a year ago by the Clio Power & Mining Co., and $55,000 in bonds were issued, no part of which was paid. It was formerly a producer and in the last year had again been placed in the producing class. It is situated near Jacksonville.

Tarantula—Five men were overcome by gas in this mine, near Chinese Camp; it is reported that one died. It is stated that a new cyanide plant is to be built. The mine is equipped with a 20-stamp mill.

Sunnyside—A cyanide plant and a boarding house are being built. It is reported that ore of good quality is being mined. The property is operated by Los Angeles men. Mr. Walker, of Sonora, is superintendent.

O. K.—A bond on this property north of the Rawhide mine given by the Tuolumne County Bank has been transferred to A. A. Coud, of Reno. It is reported that active development will be started immediately.

YUBA COUNTY

Yuba Consolidated—The pit is being dug preparatory to construction of the No. 1A all-steel 15-cu.ft. bucket dredge in the Yuba Basin district, at Hammonton. The boat will be built by the Yuba Construction Co., at Marysville, P. R. Parker, superintendent. The field construction will be in charge of P. E. Morse, general superintendent of construction for the Yuba Construction Co.

Colorado

GILPIN AND CLEAR CREEK COUNTIES

Eureka—This mine, long idle, is being rapidly put in shape by Superintendent Bray for active development. A new Clayton compressor is on the ground and will be installed as soon as the shaft house has been enlarged and a 50-hp. motor will be put in place to run the compressor. The shaft is 700 ft. deep and is equipped with pumps. It is stated that at the 600 level, a shoot of ore has been exposed for 240 ft. in length. The shaft will be sunk another 300 feet.

Pelican—Frank Graham, lessee, is employing a force of 12 men, and a heavy tonnage of mill ore is being broken. During the last two months the 50-ton mill has been enlarged and shortly after the first of December not less than 100 tons will be treated daily. There is now waiting treatment several hundred tons of custom ore, the product of the Gambetta and Josephine mines.

Idaho Pride—This company sent out a 50-ton shipment last week that averages better than $46 per ton. The 400-ft. tunnel level has been retimbered and is now ready for stoping. Driving from the Seaton to the Idaho-Bride vein is now underway.

GUNNISON COUNTY

Activity among lessees, on Fryer Hill, in their search for zinc-carbonate ore, continues, and a good tonnage is going out in addition to the iron ore being shipped.

A big strike has been made in the Raymond mine in a vein intersected by the long crosscut. This is on the same series of gold veins as the Gold Links and the Carter. All three have mills on Ohio Creek, and all three work the veins through crosscuts from 2000 to 6000 ft. long. The ore is galena and iron pyrite, the smelting ore carrying from 2 to 16 oz. gold per ton, about 9 oz. silver and 10% lead. The Gold Links has taken $500,000 out of one stope in one shoot 1500 ft. long. The new strike on the Raymond is probably on a parallel vein to this, known as the Sacramento. Eugene Lamont is the manager. The Carter mine and mill is under the management of Carroll Carter.

LAKE COUNTY—LEADVILLE

Little Johnny—This mine still continues to produce occasional lots of rich ore, and it is said that in November, several lessees opened new oreshoots, thereby largely increasing the tonnage. Some of the ore taken out assayed 200 oz. in gold and the statement is made that several lots were actually settled for at the Arkansas Valley smeltery at 70 oz. gold per ton.

Ponsardin—A 33-ft. shoot of 18% zinc-carbonate ore has been opened by

lessees on this property, but just too low grade to ship.

La Plata—This mine, on Rock Hill, continues to ship a good tonnage of zinc-carbonate ore weekly, and from the size of the shoot, this can be kept up for many months.

Mount Champion Mining Co.—The mill and tramway have been completed and sufficient ore has been opened to repay the capital. Four streaks of fair milling ore, about eight feet in width, have been opened. The mill has a capacity of 75 tons per day and consists of Simons and disc crushers and tube mills. A new tunnel from the Half Moon side of Mt. Champion is contemplated and will cut the oreshoots at a great depth.

SAN JUAN DISTRICT

In the U. S. district court, Federal Judge Lewis denied the injunction asked for by the Cimarron company to restrain the Tomboy company from using the water from the Ophir tunnel and Thorne Lake, for the mill in Savage Basin.

Hamlet—Etienne A. Ritter is expected at Silverton to make arrangements to have work resumed on this mine, which was one of the early shippers.

Tomboy—During November, 10,000 tons of ore was crushed at this Exploration Co., Ltd., of London, property, from which $86,000 worth of bullion and concentrate were recovered, the net profit being $34,788.

TELLER COUNTY—CRIPPLE CREEK

Portland—The rich shoot of ore opened on the 1600 level of the Portland mine, has been developed already for 150 ft. into both north and south headings in high-grade ore. As soon as recession of water will permit, the company will see what the 1700 will produce. From 15 to 20 carloads per month are being shipped by lessees.

American Eagle—This mine, belonging to the Stratton estate, and under lease to the Colorado Mines & Investment Co., has just sent out a carload of medium-grade ore, mined by Matheson & Co., sublessees.

Coriolanus—This mine, on Battle Mountain, is operated by Colonel Burbidge, manager of the Alboa Gold Mining Co., and has just sent out a carload of mill ore. This company is opening considerable ore ahead of extraction.

Isabella—A carload of ore per day is being shipped from the Lee dump by Knute & Fackerill, lessees.

Acacia—The tenth dividend of 1c. per share has been declared, payable at Christmas. This makes a total of $136,699 paid to stockholders.

El Paso—It is stated that the October dividend of 2c. per share paid in October, amounting to $49,000, will be duplicated this month. El Paso surplus is given at $140,000 and the company is earning at the rate of 24% per annum on its capital and paying dividends at the rate of 12%. The production for November was 144 carloads of ore; 100 carloads shipped on company account, averaged $30 per ton, and 44 cars by lessees averaged $18 per ton.

Idaho

BONNER COUNTY

Idaho-Montana—The company has about 1500 tons of high-grade silver-lead ore piled up at Katka awaiting the completion of the Great Northern spur to that place. Development is being pushed at the 300-ft. level with encouraging results.

IDAHO COUNTY

Brown Bear—Development has been suspended indefinitely, owing to lack of funds.

Major Group—Work on the shaft is progressing rapidly and the oreshoot, which averages three feet in width shows a gain in value with depth.

KOOTENAI COUNTY

Idaho Continental—The sawmill machinery has arrived and during the winter lumber will be sawed for the 300-ton concentrator which the company plans to build in the spring.

Pend d'Oreille—The long crosscut tunnel has reached the 1000-ft. mark. About 200 ft. more must be driven to cut the vein.

SHOSHONE COUNTY

National—An excellent body of copper ore of unknown width has been developed for a length of 125 ft. at a point 1700 ft. from the surface. This is the most important strike in the Mullan district this season and is having a stimulating effect on the owners of near-by properties.

Gertie—At the annual meeting of the stockholders it was decided to resume operations on this property.

National Copper—High-grade copper ore rich in silver has been encountered in a 200-ft. drift at the end of the 4500-ft. tunnel.

Last Chance—The old "L" and "M" stopes, long since abandoned, will be reopened and the filling will be taken out and worked in hand jigs.

Western Silver-Lead Mining Co.—A vein of clean galena has been opened in this property. Development shows that former operators had driven parallel with the oreshoot for a considerable distance.

Hypotheek—The 700-ft. level is being unwatered in preparation of the work of seeking the extension of the orebody found on the 523-ft. level. Shipments have been begun from the ore encountered on the 523-ft. level, which appears to be the top of an oreshoot.

Michigan

COPPER

Old Colony—No. 19 drill hole reached the Mayflower lode at a depth of 1474 ft., which at the point of intersection was about 14 ft. wide; but the core showed evidences of faulting and it is likely that a portion of the lode had slipped below the point of contact, which explains the comparative narrowing of the lode. This hole was put down further east than any of the previous holes in either this or the Mayflower property.

Indiana—This company is installing a new hoisting equipment, which will be ready to go into commission within a few weeks.

North Lake—Sinking has been temporarily suspended at a depth of about 50 ft. The hoisting equipment now in service at the Indiana property has been bought and as soon as it can be installed operations will be resumed, in the meantime a temporary shaft house is being erected and the other necessary mine buildings, so that when sinking is again resumed it can go forward without interruption.

Michigan—This mine has resumed exploratory work, and a new shaft has been started which has penetrated the overburden and is well established in the lode. A crosscut is also being driven to the north, toward the Butler lode. It is deemed advisable to start this work from the good results that were shown in the drilling work done about a year ago.

Centennial—An increase has been made in the shipments to the mill, about 500 tons daily being handled, also a slight improvement has been noted in the copper tenor of the ore in the lateral openings in proximity to the Wolverine.

Allouez—This mine is sending about 1200 tons of ore to the mill daily, being about equally divided between Nos. 1 and 2 shafts. The rock house at No. 1 shaft is to be remodeled for more efficient handling of the rock from the dump to the crushers, and an enlarged skip will be put in service at this shaft. The No. 2 shaft equipment is working satisfactorily.

IRON

Ashland—The Cleveland-Cliffs Iron Co. surrendered its lease on this Gogebic range mine, at Ironwood, Dec. 1, and will remove its machinery. It is understood that the Hays Bros., to whom the mine reverts, will operate it. The mine was opened in 1884, and has shipped ore every year since then, making a total of nearly 6,000,000 tons. The Cleveland-Cliffs Iron Co. has operated the property for the last 10 years and has averaged approximately 250,000 tons per year. It is thought that the ore reserve of the mine is rather low The ore is of good grade.

Rolling Mill—The new Sullivan hoist for No. 2 shaft just completed has been installed in the engine house. The new shaft and equipment will be used to handle men and material for some time at least, while No. 1 shaft will continue to hoist ore.

Cleveland-Cliffs Iron Co.—For several weeks this company has been calling for more men for its Negaunee and Maas mines. There are now 425 men at the Negaunee mine and 175 men at the Maas mine. It is expected that by next spring these two mines, which are adjacent, will be employing nearly 1000 men, which is more than ever before. At the Negaunee mine the old shafts and buildings have been abandoned, and the new No. 3 shaft and elaborate equipment are in full operation.

Breitung-Hematite—The hoisting shaft is being sunk deeper and will be continued 180 ft. below the bottom level; one-man "Jackhammer" drills are used in sinking. A crosscut will then be driven 600 ft. to the south and a raise put up to connect with the new hoisting shaft that will soon be sunk on the hill back of the mine buildings. A diamond-drill has been testing the ground at the proposed site and has demonstrated that at last a place has been found where there is no ore. The shaft to be sunk here will eventually be 2000 ft. deep. The management of this mine has been trying to find a place for a new shaft for two years.

Missouri

Joplin District

The Aylor land, west of Purcell, is now the scene of much mining activity. The land is being drained by three large pumps and lessees are waiting for the water level to be lowered before commencing operations. Prospect drilling is in progress on a 40-acre lease of the land.

Most of the concentrates from the Alba camp are coming from the old tailing piles which are being remilled. Nesbach & Co. are operating a number of mills which formerly handled large tonnages of mine dirt but are now converted into tailing mills. The East Alba Mining Co., operating a 300-ton mill at the eastern end of the camp, is the only company making regular productions from mine-run ore.

Stewart Mill—The Stewart tailing mill, between Carterville and Webb City, was destroyed by fire, Dec. 3. The mill was valued at $7000 and had just been overhauled.

Porto Rico—A new mine is being opened on the W. A. Knoland. The ground has been prospected with a churn drill and by drifting, sheet ground being proved at 190 ft., similar in character to that of adjoining properties. The mill is being moved from the Marvel mine at Duenweg and is to be remodeled to have a capacity of 150 tons.

New Dividend—This company, operating on the American Lead, Zinc & Smelting Co. land, northeast of Joplin, is sinking a shaft to take care of the ore from the drawing of pillars. The underground haul will be lessened and an inclined tramway will be built from the new shaft to the mill.

Otis Mining Co.—This company is moving the old Millard mill from Porto Rico to West Seventh street, Joplin. It will be installed at a mine developed by Spiva & Co. and will operate on 5% ore.

Quick Seven—Because of the ore extending to within 20 ft. of the surface over a part of the company's holdings, at Neck City, and the numerous cave-ins that have occurred, this company has decided to install a steam shovel and work the ground from the surface down. The ore will then be handled by an inclined tramway instead of a combination of aërial tram and underground haulage as at present.

Montana

Butte District

Butte & Superior—On Nov. 28, the newly installed Nordberg hoist at the Black Rock shaft, was tried for the first time. A few minor adjustments are now being made, but it is expected that ore hoisting will begin in a few days, after the shutdown of two months to change the engines. Remodeling of the mill is about completed, and while the present stockpile output will not be materially increased at once, the quantity of ore treated will be gradually added to until the full capacity is reached.

Davis-Daly—The grade of ore in the north vein on the 1900-ft. level of the Colorado shaft is increasing as progress is made in drifting. Recent assays gave returns of 5.3% copper and 9.3 oz. of silver per ton. About 90 tons of ore are being mined and shipped daily from the Colorado shaft alone, and in addition, a considerable amount in royalties is being received from lessees operating other claims. The present shipment tonnage is the greatest in amount and regularity in the history of the company.

Deer Lodge County

Blue-Eyed Nellie—Spokane men have had a force of five men engaged during the last few weeks cleaning out this silver-lead mine, three miles west of Anaconda, for the purpose of making a careful examination. The property was closed 12 years ago, after having produced approximately $750,000 worth of ore. Before the slump in silver, Frank Brown, the owner, was offered a large sum for the property, which he refused. Later Mr. Brown erected a mill, which he was unable to operate profitably and the shutdown resulted. W. A. Clark at one time owned an interest, which he disposed of after unsuccessfully attempting to gain control. The ore is similar to that in the Leadville, Colo., district.

Red Lion—Two shifts are working steadily at this property, at Georgetown, and low-grade ore has been blocked out, which can now be mined profitably.

Butte & Anaconda—At the property of this company, which lies between the Southern Cross and Red Lion groups, a shaft is being sunk on a vein believed to be an extension of the Southern Cross vein. It is the intention to begin driving on the vein in both directions within a short time, as well as to crosscut to the other veins on the property.

Hidden Lake—Occasional shipments of ore are being made from this property, but the management is principally interested in blocking out ore for shipment by the railroad; such shipments will probably begin in a short time.

Sanders County

Mountain View—Preparations are being made to begin operations at this property, which consists of eight quartz and three placer claims, eight miles northeast of Trout Creek, near the Summit of the Cabinet range of mountains. The property is traversed by a number of strong silver-lead veins in quartzite, and limestone-slate formations. Considerable surface development has been done, and three tunnels having lengths of 50, 75 and 175 ft., respectively, have been driven on the veins. It is planned to drive a crosscut tunnel a distance of 1200 ft. to tap three known veins. In this distance a vertical depth of 1600 ft. will be attained. A. J. Williams is president; James Hvlent, vice-president, and W. E. Williams, secretary and treasurer of the company.

Nevada

Comstock Lode

Union Consolidated—The annual report of Superintendent Symmes of work performed in the mine, during the last fiscal year, shows a total footage of 2043 ft. of exploration and development work done. Most of this was performed on the 2500-ft. level. The work has not resulted in the discovery of new orebodies.

Mexican—The annual election was recently held in San Francisco, when the entire old board of officers, and mine officials, were reëlected for another year. The financial sheet showed available resources of about $85,000, including $70,000 in cash, and the balance in supplies on hand and paid for, and bullion unsold. The annual report on mine conditions by Superintendent Symmes was favorable.

Ophir—The first cleanup has been recently made at the new cyanide plant, and six bars of bullion have been shipped to the smeltery.

Consolidated Virginia—New work is being done on the 2500-ft. level of the mine, the southwest drift from Ophir being continued on from the north boundary line in a southerly direction. The objective point is to reach the vein in which a rich shoot of ore was found on the 2400-ft. level.

Sierra Nevada—Work has been resumed, driving north on the vein on the 2500 level, with quartz showing in the face. A raise has also been started at a place where high-grade ore was extracted from the vein.

Crown Point—Complete returns have been received from the smelter of concentrate and bullion shipments from the last run of ore at the Yellow Jacket mill, showing a gross yield of $25,413. This run was completed in October, and run No. 9 has now been started.

Esmeralda County

Goldfield Consolidated—The production for November is officially estimated at $429,000, recovered from 27,614 tons of ore at a net profit of $244,000.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Nov. 30, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,700	161,219
Tonopah Belmont	2,924	120,818
Montana-Tonopah	1,009	49,155
Tonopah Extension	1,050	48,413
West End	800	37,027
Midway	.....	820
MacNamara	417	18,156
North Star	.....	401
Mizpah Extension	.....	40
Jim Butler	300	4,700
Tonopah Merger	200	300
Totals	10,400	441,049
Estimated value	$260,000	

White Pine County

Giroux—According to Thompson, Towle & Co., this company has been earning upward of $60,000 per month on a production of approximately 1,000,000 lb. of copper. Inasmuch as copper has been realizing upward of 17¼c., the reported profit indicates a cost of production of about 11¼c. per lb. of copper.

Oregon

Josephine County

Pacific Interior R.R. Co.—This company has been incorporated for building a railroad from Grants Pass, Ore., to tidewater at Crescent City, Calif., 80 miles. The incorporators are E. T. McKinstry, George Colvig and W. P. Quinlan and the company is capitalized at $100,000 in 10,000 shares each of $10 par value. The principal place of business is Grants Pass. Grants Pass will vote, Dec. 18, on a bond issue of $200,000, to help finance the road; $250,000 has been raised at Crescent City. The railroad will enable the opening of many mines in this vicinity that at present are idle.

Lake County

C. M. Sain, together with other Los Angeles men, is preparing to obtain salt, potash and soda products from Alberta and Summer Lakes, which are said to contain 40,000,000 tons of salts of potash and soda. The Oregon state land board leased these lakes for 40 years to Mr. Sain and his associates, who guarantee to pay a royalty of at least $50,000 per year, starting with 1913. Royalties will be $1 per ton on all soda and potash taken from the lakes and 50c. per ton on common table salt. The nearest railroad is Lakeview, Ore., which is 40 miles from the lakes.

Lane County

Treasure—Charles A. Phelps, of Los Angeles, Calif., and associates, have taken over this mine in the Blue River district and will commence development work at once. A vein of rich free-milling ore was recently found. The mine is equipped with a 12-stamp mill, which is in good condition. Mr. Phelps will have charge of the mine.

Utah

Juab County

May Day—There is a large tonnage of zinc ore developed, and the lead ore of shipping grade recently opened on the 1100-ft. level is being developed. November shipments are reported at 1300 tons, of which 250 tons were lead ore, and the remainder, zinc. December shipments are expected to amount to 2000 tons. The output for the week ended Nov. 30 was 12 cars.

Opohongo—Two cars were shipped the week ended Nov. 30, the ore coming from between the 350- and 600-ft. levels. Driving to the east is being done on the 300-ft. level, as well as prospecting at depth. There is some ore in the bottom of a winze 50 ft. below the 700-ft. level.

Gemini—At a stockholders' meeting held by this company and the Godiva, the old board of directors was reëlected. In the beginning of November, the Gemini declared a dividend of $6 per share, or $30,000, the capitalization being 5000 shares. Lessees are mining zinc ore, of which two cars were shipped recently. Shipments for the week ended Nov. 30 amounted to five cars.

Yankee—This company shipped three cars of zinc ore of good grade the week ended Nov. 30.

Grand Central—Ore is being shipped from the 2300, the lowest level in the mine, and conditions here are reported excellent. The output for the week ended Nov. 30 was 13 cars.

Victoria—This company expects to complete the electrification of its plant in the near future. A new compressor has been ordered, and when this is in operation, work can be extended, and shipments increased. Six cars were shipped the week ended Nov. 30.

Chief Consolidated—Shipments for the week ended Nov. 30 amounted to 24 cars.

Gold Chain—Ore of shipping grade has been opened in the western part of the property, through the 1500-ft. level of the Gold Chain. Nine cars of ore were shipped the week ended Nov. 30.

Lower Mammoth—Four cars of zinc ore were shipped in November. Development is being done on the 700-, 1200- and 1500-ft. levels.

Salt Lake County

Utah Copper—The surface force has been increased and is now about 80% of the usual number. The output for October was 2,188,792 lb. The regular quarterly dividend of 75c. per share has been declared, payable Dec. 31.

Michigan-Utah—Arrangements for financing development work have been completed.

Alta Consolidated—A drift has been driven westward for 50 ft. from the Brooklyn raise, and north and south crosscuts from this drift have opened ore over a distance of 10 ft. Connections with the Brooklyn shaft have been completed, improving the air, and facilitating shipments. Twelve teams are hauling ore. Arrangements have been made for the use of the Michigan-Utah tramway. The new boarding house has been completed, and winter supplies laid in.

Ohio Copper—The final dividend of 25c. per share in liquidation is ready for stockholders who failed to meet either of the two recently levied assessments of 50c. per share. The dividend will be paid by the New York office upon receipt of certificates of stock properly indorsed. The working force is sufficient so that two sections of the mill can be operated, and between 1700 and 2000 tons of ore is being treated daily.

Summit County

Park City shipments for the week ended Nov. 30 amounted to 3,044,650 pounds.

Daly West—A strike on the 1700-ft. level is reported.

Daly-Judge—The regular quarterly dividend of 15c. per share has been declared, with an added Christmas dividend of equal amount, making a total of $90,000, to be paid Dec. 20. The report for the quarter ended Sept. 30 showed a surplus of $540,000. Steady shipments are being made, while ore reserves are being added to.

Washington

Ferry County

El Oro Mining Co.—This company has been organized with offices at Spokane for the purpose of building a 125-ton cyanide mill at Republic for treating the ores of that vicinity. A site has been selected, and work is to be started at once.

Keller & Indiana Smelting Co.—This property, at Keller, was recently sold at public sale to Jasper King and H. J. Lefever, of Walla Walla, who are planning considerable development work.

San Poil—The mill at this property in the Republic district has now been running 70 days, with an output of $23,000 in gold and silver bullion.

Lewis County

Mutual Oil & Development Co.—This company has recently been organized with headquarters at Centralia. It has leased 1000 acres of land in that vicinity and will begin drilling for oil.

Stevens County

Imperial—Operations at this mine have been suspended and will not be resumed until Mar. 1, 1913. A. H. Anderson, Chewelah, is superintendent.

Blue Star—A pump and other machinery have been purchased and are being installed at this property near Chewelah by Mark Mitchell.

Chewelah Copper King—New machinery is being installed at this mine, and the company expects to make regular shipments in the near future. S. P. Domer has charge of the work.

Canada

British Columbia

Kootenai Gold Mines, Ltd.—The capitalization of this company will be increased from $250,000 to $500,000 if the decision of the directors is ratified by the stockholders. The company owns the Granite-Poorman mine.

Ontario

Parham Feldspar Mine—A shipment of ground feldspar from this mine, in Frontenac County, 30 miles north of Kingston, has been made to the Ideal Manufacturing Co., Port Hope, Ont. This is stated to be the first feldspar mined in Canada.

Moose Mountain—A briquette of iron ore produced by the Grondal magnetic concentrating process from the output of the Moose Mountain iron mine, north of Sudbury, has been received by the Ontario Bureau of Mines. It contains 63.40% of metallic iron, 0.02% phosphorus and is free from sulphur and is pronounced to be of bessemer quality. The company also has contracts for ore which does not require briquetting.

Ontario—Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Dec. 6, and for the year to date, were:

Bailey		21.57
Beaver		363.75
Buffalo	114.34	1,103.84
Casey Cobalt		255.15
Chamb.-Ferland		427.83
City of Cobalt		914.99
Cobalt Lake	100.15	961.03
Cobalt Townsite		1,729.02
Colonial		63.14
Coniagas	123.57	1,997.90
Crown Reserve	20.02	437.84
Dominion Reduction Co.		56.64
Drummond		383.05
Hudson Bay	31.65	662.85
Kerr Lake		743.05
La Rose	60.00	3,291.09
Lost & Found		27.80
McKinley-Darragh		2,350.99
Nipissing		1,735.62
O'Brien		325.43
Penn.-Canadian		97.90
Provincial		22.22
Right of Way		242.82
Seneca Superior	32.26	227.89
Timiskaming	43.85	958.66
Trethewey		504.89
Wettlaufer	30.25	437.21
Totals	556.09	20,344.17

Buffalo—During October the mill ran 586 hr. and treated 4438 tons of ore, from which 213,608 oz. of silver was recovered.

Cobalt Lake—A dividend of 2½% has been declared. The output for the current year is officially estimated at approximately 1,000,000 oz. Early next year 20 additional stamps will be installed.

Mann—A concentrator is to be built at this Gowganda property. The gross value of the ore produced during the last year was over $100,000.

Ontario—Porcupine

Jupiter—The Drummond Syndicate, of Montreal, has exercised its option on the treasury stock of this company at 40c. per share. There will be sufficient cash and stock in the treasury to assure the development of the property and building a mill.

Hollinger—Two bars of bullion, valued at approximately $30,000, have been shipped this week. No financial statement accompanied the dividend checks for November as the last statement was brought down to Oct. 25 and there were only four more days left in the month. At the time of the next dividend payment, the statement issued will indicate the present position of the mine.

Quebec

Loughborough Mica Co.—This Ottawa company has established a new mica splitting plant at Maniwaki, Que., which gives employment to 100 operators.

Yukon Territory

Boyle Concessions, Ltd.—All properties of the Granville Mining Co. in the Klondike watershed have been merged with those of the Canadian Klondike company; the combined property, comprising about 40 sq.mi., will hereafter be operated as Boyle Concessions, Ltd. Two Marion 16-cu.ft. bucket dredges have recently been completed on Bonanza Basin at the junction of the Klondike and Yukon Rivers; these dredges will not be started until next May. The Granville Mining Co. will have a 49% interest in the new incorporation and will continue the operation of its other properties.

Mexico

Mexico

A force of rebels recently attacked the town of Temascaltepec, near Toluca, but was repulsed with heavy loss.

Oaxaca

All the heavy machinery for the Cubilete mill, at Taviche, has been received at Ocotlan. The installation, however, is being postponed until conditions in the state are improved. The erection will be undertaken under contract, and four months will be required to finish the job. The mill will have a capacity of 150 tons per day, and will not only treat ores from the company's mines, but undertake a general custom business. This will be the first cyanide mill in the district.

Zacatecas

Protectora—This mine, at San Salvador, a producer of high-grade copper-silver ore, resumed operations in July of this year, after a shutdown of four years. Recent exploration work has disclosed ore containing 18% of copper and 800 grams of silver. Shipments at the rate of 250 tons per month are now being made regularly. The ore occurs as irregular bodies and cave filling in limestone, and the minerals are the carbonates and oxides of copper and silver chloride. No water is encountered in this region of the central plateau of Mexico for a depth of several hundred feet. No timbering is required at this property, and gasoline hoists are employed. About 200 men are on the payroll. The property was a small dividend payer during 1906 and 1907, and on Dec. 15, 1912, will resume dividends, the board of directors having declared a 5% dividend on the capital stock for that date. P. A. Babb is president of the company and engineer.

Asia

Chosen

Oriental Consolidated—The cleanup for November is estimated to be worth $141,500.

Philippine Islands

Philippine Exploration Co.—The 6-cu.ft. bucket gold dredge, built by the New York Engineering Co., for the Gumaus placers, in the Paracale district, was completed and put in operation for the first time Sept. 25, 1912. It is a typical modern Empire dredge with timber hull.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Dec. 11—The situation in the West remains about the same, with the exception of a slight improvement in car supply. Prices have eased off a trifle, but there is no important change.

The seaboard bituminous trade again shows rather better supply, with less pressing demand from the coastwise trade. The shoal-water ports are very near closing.

Anthracite is coming out more freely and dealers are less urgent in their demand for supplies, although the cold snap this week has developed a larger demand for domestic sizes. Shipments this month are keeping up well.

Shipments of coal through the Sault Ste. Marie canals in November were 1,849,093 short tons, making a total of 14,468,497 tons for the season.

Anthracite shipments in November were 6,165,636 long tons, being 499,785 tons less than in October, and 27,778 tons less than in November, 1911. For the 11 months ended Nov. 30, the total was 63,838,872 tons in 1911, and 57,666,076 in 1912; a decrease of 6,172,796 tons this year.

German Foreign Trade—Exports and imports of fuel in Germany, 10 months ended Oct. 31, metric tons:

	Exports	Imports	Excess
Coal	25,723,783	8,478,727	Exp. 17,250,056
Brown coal	44,766	6,028,872	Imp. 5,984,106
Coke	4,816,143	494,174	Exp. 4,321,969
Briquettes	2,236,672	146,266	Exp. 2,090,406
Total	32,826,364	15,148,039	Exp. 17,678,325

Of the briquettes exported, 475,536 tons were made of brown coal or lignite.

Spanish Coal Trade—Imports of coal into Spain, nine months ended Sept. 30, were 1,653,010 metric tons, an increase over 1911 of 100,591 tons. Imports of coke were 266,994 tons, an increase of 32,223 tons.

Iron Trade Review

New York, Dec. 11—The iron and steel trades show little change from recent reports. The pressure on mills for deliveries is quite as strong as it was.

The past week has shown a further diminution in far forward business in steel products, and it is a question in the trade whether the decrease represents a change of sentiment on the part of buyers, or is simply due to the business being already done for a period as far ahead as buyers usually care to commit themselves.

The National Tube Co. of the Steel Corporation, through the export branch, has booked a record order for line pipe, involving about 550 miles of 5-in., 9-in. and 10-in. pipe, about 35,000 tons. The pipe is taken by the Rumanian government, to build a line from the Rumanian oil fields to the Black Sea. The National Tube Co. has booked also an order for 20 miles of 20-in. line pipe from the Hope Natural Gas Co., a Standard Oil interest, operating in the West Virginia field.

The Steel Corporation's unfilled orders at the close of business, Nov. 30, were 7,852,883 tons, the record since 1906, when much was included in "unfilled tonnage" which would not meet the more conservative policy in compilation since adopted The November gain in unfilled tonnage was 258,512 tons, against 1,042,874 tons in October, which was the record gain for a month. The total bookings showed a decrease of about one-third from October to November, shipments being practically at capacity in each month.

Pig iron is a little less active, so far as new buying is concerned. Purchasers of steel-making irons seem to be satisfied for the present, and foundry-iron orders have been for comparatively small lots, though it is known that several large contracts have been under negotiation in seaboard territory.

Pig-Iron Production—The reports of the blast furnaces as collected and published by the *Iron Age*, show that on Dec. 1, there were 283 coke and anthracite stacks in blast, having a total daily capacity of 86,950 tons; a decrease of 1350 tons from Nov. 1. Making allowance for the charcoal furnaces, the total make of pig iron in the United States in November was 2,660,900 long tons; for the 11 months ended Nov. 30, it was 26,895,325 tons. Of this total approximately 19,688,400 tons, or 73.2%, was made by the furnaces owned or controlled by the steel companies.

Baltimore

Dec. 9—Exports for the week included 445,463 lb. miscellaneous iron and steel to Havana. Imports included 5500 tons pyrites from Huelva, Spain, 5700 tons iron ore from Cuba.

Birmingham

Dec. 9—The last month of the year promises to be interesting in the Southern iron and steel markets. The production will be kept up to the pace set and shipments are not to be interrupted if possible. Some pig iron is being shipped from this district for export, the month to see about 5000 tons of iron started for foreign shores. The quotations for pig iron continue around $15 per ton, No. 2 foundry, delivery during the first half of the year. There is a considerable inquiry for iron, delivery during the first half of 1913. The home consumption is active, pipe makers in particular melting steadily.

The activity in steel is unabated. There is need for active operations at the several plants. Rails are being delivered as quickly as they can be produced and inspected. Additional orders are looked for shortly. Fabricated steel is far from being slow. Concrete-steel rods are in strong demand and the plant of the Southern Iron & Steel Co., at Gadsden, is behind in filling orders. Efforts will be made to lose as little time as possible at the steel works in this section during the holiday season.

The production of pig iron in Alabama reached about 167,000 tons in November.

Chicago

Dec. 10—The iron market remains quiet. Pig iron is in a very quiet condition; sales are small and are expected to remain small until after the first of the year. Inventory time approaches and demand naturally slackens, while the imaginary line of the first is a signal for cautious buying to many. There are a few sales of standard foundry irons, with prices firm, Northern No. 2 holding to $18 furnace (about $18.50 delivered) and Southern No. 2 to $14, Birmingham ($18.35, Chicago), for delivery anywhere up to the end of the first half. Lake Superior charcoal holds to $18.75, Chicago.

The pig-iron situation is fairly satisfactory to selling agents and there is no reason to believe that it means weakness of the market; the cessation of buying is the customary thing at this time of the year and no disposition exists on the part of the furnaces to unload at any cost. They are well sold up to at least the end of the first quarter, in general, and they, as well as the melters, can afford to wait.

In the market for finished products, dullness is a little more pronounced; the approaching holiday season affects business generally as a brake. Railroad supplies are still actively in demand and the problem is of delivery; the leading roads are buying heavily or preparing for large

purchases soon; standard rails and track fastenings alike are in demand for delivery as soon as possible, though that may be several months hence. Structural-material contracts are somewhat in abeyance, owing to weather and difficulties of delivery, but are sought. The market for bars is still an eager one on the part of the purchasers; steel bars are deliverable only far in the future and iron bars find a brisk market at high figures. Plates and sheets are eagerly sought for second-quarter delivery, but mills are so crowded that the seller has by far the advantage. In practically all lines of finished goods, in short, the pressure for supplies continues great, and the outlook for future business is highly promising.

Cleveland

Dec. 9—November shipments of ore from the upper ports were 4,066,129 tons. Since Dec. 1 three small cargoes, about 12,500 tons in all, are reported, which will probably close the season.

Pig Iron—Demand is fair and the market is firm, furnaces finding no trouble in getting the advanced prices. Current quotations are $18.25@18.50 for bessemer, $17@17.25 for basic, $17.75@18 for No. 2 foundry, $19.75 for Lake Superior charcoal, all Cleveland delivery.

Finished Material—The mills are in a strong position and are not chasing orders. Some structural steel is being ordered now which will not be needed until spring. There is a strong demand for reinforcing bars for concrete work.

Philadelphia

Dec. 11—Demand for pig iron has fallen off in large purchases but numerous small lots for earliest possible delivery are reported. The oversold conditions and the known winter and spring necessities of many consumers enable makers to keep up prices. With all the check to demands, both basic and bessemer are nominally higher, but there are fewer over-anxious buyers who want to see how the crude-iron market can hold itself together. Makers say they will soon find out all they want to know. Producing capacity is strained to the limits and the furnaces are groaning under the lash. The next scramble will be for forge and knowing makers wink when they are asked what January quotations will be. Mill owners are very anxious to arrange for large lots, even though at present fairly supplied. First quotations today are: No. 2 foundry, $18.50; forge, $17.75; basic, $18.50. Southern iron is held with exceptional firmness.

Steel Billets—Nothing has developed to warrant any change of views expressed a week ago. Quite a lot of partially concluded business is hanging fire.

Bars—The almost imprecedented rush of car-building work and the low condition of stocks of refined iron in consumers' hands accounts for the urgency of demand at the mills and the growing lateness of delivery. The oversold condition of mills has not been equaled for years.

Pipes and Tubes—The possibility of an early modification of discounts has had a stimulating effect on demand for later deliveries.

Plates—The pressure for plates is increasing. The mills are unable to do more than to name dates when they will have capacity to offer.

Structural Material—The oversold conditions of some Western mills has washed back a good deal of business into this territory, some of which is accepted under the elastic agreement to do the very best possible. New bridge requirements for winter delivery have been booked.

Steel Rails—A number of fair-sized orders for Eastern and Southern systems have been placed with the arrangement that they will be squeezed in between bigger orders. Capacity is being kept in cold storage for a lot of business long talked about but not yet placed.

Scrap—Scrap dealers have been able to keep within sight of their promised deliveries, but the trouble is that scrap is not made as fast as it is wanted. Yards look bare.

Pittsburgh

Dec. 10—The Carnegie Steel Co. this week scheduled for full operation the mills and furnaces which had been affected by the strike, which started Nov. 28. The loss in production may have reached 50,000 tons altogether, confined to the Homestead and Edgar Thomson works. No concessions whatever were made to the men.

Pig Iron—Pig iron has become extremely scarce for prompt shipment, particularly foundry and basic. While bessemer may not strictly be scarce, it is a fact that brokers have had great difficulty even in borrowing small lots. For small lots of prompt foundry, $18, Valley, has been paid, while it is reported also that $17, Valley, has been paid for basic, for a lot of 1000 tons, these prices being 50c. above those quoted, nominally at least, as the market. It now becomes a question, however, whether furnaces would sell for extended delivery at the prices recently quoted, seeing the higher prices sometimes obtained for prompt. Inquiry is rather limited, which retards a testing out of the situation. We quote: Bessemer, $17.25; basic, $16.50@17; No. 2 foundry, $17.50@18; gray forge, $17@17.50; malleable, $17.25@17.50, f.o.b. Valley furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Sellers of ferromanganese have marked up prices again, putting the second-half price up from $61.50 to $65, Baltimore, and the contract price for first half to a minimum of $70, though some deliveries are difficult to arrange at less than $75. For carloads for prompt shipment the market is $75 to $80, Baltimore, freight to Pittsburgh being $1.95 per ton.

Steel—The market for unfinished steel is practically nominal, there being no regular quotations out. The last authentic market quotations were: Bessemer billets, $27; sheet bars, $27.50; open-hearth billets, $28; sheet bars, $28.50, f.o.b. maker's mill, Pittsburgh or Youngstown. Rods are quotable at $30, Pittsburgh, but cannot always be secured at that figure.

Sheets—There has been a decrease in specifications for sheets against regular contracts. Specifications since the first of the month have been running at perhaps 20 to 35% under shipments, but as the mills had a large accumulation they are still far behind, and many, if not the majority, have enough specifications to run them into February. Buyers have been specifying so freely of late that their low-priced contracts, good to Dec. 31, are tending to run out early. Forward contracting is diminishing, as the mills are very reserved about selling. Premiums are the rule for any delivery in the next few weeks, and some sales of galvanized over the whole first quarter have been made at premiums. We quote the general market, with higher prices paid in some cases, as follows: Black sheets, 28 gage, 2.25@2.35c.; galvanized, 28 gage, 3.40@3.50c.; blue annealed, 10 gage, 1.65@1.75c.; painted corrugated, 2.45@2.50c.; galvanized corrugated, 3.45@3.50c. per pound.

St. Louis

Dec. 9—The sales of pig iron have dropped off a trifle. This is quite natural as nearly all of the melters are well covered for the next few months. The market will probably not be so active again until after the first of the year. The demand for finished products continues to be very good. All the steel foundries and car shops are booked ahead for months. No. 2 Southern foundry iron is quoted at $14.50 Birmingham, or $18.35 St. Louis for first-quarter delivery. A premium of 25 or 50c. per ton is being asked for second- and third-quarter delivery. Northern No. 2 is in fair demand at around $19 St. Louis. Coke is still scarce and is quoted at $6.80 for the best Connellsville foundry, and $6 for byproduct, f.o.b. St. Louis.

Iron Ore Trade

In the East it is reported that 8c. per unit has been offered for Cuban bessemer ores, but sellers want 8.5c. Sell-

ers are not pressing ore, however, owing to the present difficulty of securing vessels.

Shipments of Lake Superior ore by the various railroads up to Dec. 1 are reported as below, in long tons:

Railroads:	Gross tons
Duluth, Missabe & N. (Duluth)	10,505,577
Duluth & Iron Range (Two Harbors)	9,370,970
Great Northern (Superior)	13,936,899
Soo Line (Superior)	305,000
Lake Superior & Ishpeming (Marquette)	2,224,217
Duluth, S. Shore & Atlantic (Marquette)	1,054,085
Chicago & Northwestern (Ashland)	3,776,500
Soo Line (Ashland)	1,018,788
Chicago & Northwestern (Escanaba)	4,050,190
Chicago, Mil. & St. Paul (Escanaba)	1,202,600
Total	47,444,826

A few scattering cargoes are all that can be expected in addition to these figures. The rail shipments, however, are to be added to make up the season totals. November weather was good and the upper Lake docks are unusually well cleared. A good deal of stripping and exploration work at mines will be done through the winter.

Foreign Iron Trade

German Pig Iron Syndicate—Matters have been finally arranged between the German Pig Iron Syndicate and the iron companies of Luxemburg and Lorraine. The latter have finally agreed to join the syndicate on an agreement which is to run for four years.

Metal Markets

New York, Dec. 11—The metal markets are again fairly active, but with no marked changes in price. In some lines there is a slight weakness.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January	110	111	July	112	114
February	115	109	August	117	120
March	112	111	September	111	127
April	114	115	October	112	133
May	118	118	November	111	129
June	115	117	December	110	.....

Year 1909, 115; 1910, 115; 1911, 112.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Oct. 1912	$ 330,270	$ 11,887,492	Imp. $11,557,222
" 1911	3,983,994	4,102,427	Imp. 118,433
Year 1912	44,058,544	50,677,285	Imp. 6,618,741
" 1911	22,247,304	49,279,533	Imp. 27,032,229
Silver			
Oct. 1912	6,171,820	4,683,784	Exp. 1,488,036
" 1911	5,087,087	3,404,458	Exp. 1,682,629
Year 1912	58,519,766	40,985,536	Exp. 17,534,230
" 1911	54,615,048	37,100,888	Exp. 17,514,160

Exports from the port of New York, week ended Dec. 7: Gold, $14,500; silver, $1,323,320, chiefly to London and the West Indies. Imports: Gold, $1,570,221, chiefly from London and Paris; silver, $103,203, principally from South America.

Gold—Prices on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. No more gold is reported taken in London for New York account.

Gold production in the Transvaal in November was 757,337 oz., being 11,524 oz. less than in October and 37,608 oz. more than in November, 1911.

Platinum—The market is steady and unchanged, at $45@46 per oz. for refined platinum, according to quantity; $47.50@48.50 per oz. for hard metal, up to 10% iridium.

Silver—The market continues steady to firm. It is to be noted that the prices for spot and forward silver have recently been reversed. Whereas futures for a long time had commanded a premium over spot, now spot is ⅛d. higher than futures. This is owing to an apparent scarcity of silver in London for prompt delivery. This helps to give tone to the general market.

SILVER AND STERLING EXCHANGE

Dec.	5	6	7	9	10	11
New York	64	63¾	64⅛	64⅛	64⅛	64
London	29⅜	29 9/16	29 11/16	29 11/16	29 11/16	29⅜
Sterling Ex.	4.8445	4.8455	4.8445	4.8465	4.8455	4.8465

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

Copper—The market has again experienced a very dull week, but at the close there is perhaps a little better tone, inspired by the idea that manufacturers, both at home and abroad, cannot much longer delay the replenishment of their stocks. The leading producers continue to stand firmly for the pegged price. The small volume of business that is being transacted represents hand-to-mouth buying by manufacturers from the smaller producers who are willing to sell. Some moderate sales of electrolytic for December delivery were made this week at 17.40c., cash, New York. There were lower offerings for January and later deliveries. In fact one small sale corresponding to 17.25c., cash, New York, was reported. Some small sales of special brands of Lake copper were made at 17¾c., but good ordinary brands of Lake copper sold at 17½@17⅝c. Although consumers, both in this country and Europe, have continued to refrain from buying, there has been more inquiry during the last few days, and it is noteworthy that interest is shown by consumers in copper for early delivery. This is considered to confirm the reports to the effect that stocks in the hands of manufacturers are very low indeed. Consumption continues excellent and a buying movement is expected shortly.

NEW YORK

Dec.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
5	17½ @17¾	17.35 @17.40	49½	4.35	4.20	7.10 @7.20	7.05 @7.15
6	17½ @17⅝	17.35 @17.40	49¼	4.35	4.20	7.10 @7.20	7.05 @7.15
7	17¼ @17⅜	17.35 @17.40	49¼	4.35	4.20	7.10 @7.20	7.05 @7.15
9	17⅛ @17⅜	17.35 @17.40	49⅛	4.30 @4.35	4.15 @4.17½	7.10 @7.20	7.05 @7.10
10	17⅛ @17⅜	17.35 @17.40	49¼	4.30 @4.35	4.15 @4.17½	7.10 @7.20	7.05 @7.10
11	17¼ @17⅜	17.35 @17.40	49¼	4.30 @4.35	4.15 @4.17½	7.10 @7.20	7.05 @7.10

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Dec.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'd	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
5	75⅞	76¾	82½	226¼	225½	18 1/16	26½
6	75¼	76⅛	82	225⅜	225	18 1/16	26½
7	....	....	.....	.....	.....	....	....
9	75⅞	76¾	82	226½	225⅞	18 1/16	26¼
10	75½	76½	82	225	225	18 1/16	26¼
11	75½	76½	82	225	225	18 1/16	26¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

The Producers' Association's statistics were favorably received, the increase in this country being counterbalanced by the decrease in stocks abroad and the world's supplies remaining at a comparatively small figure. At the close, Lake copper is quoted 17½@17⅝c.; electrolytic in cakes, wirebars or ingots, 17.35@17.40c. Casting copper is quoted nominally at 17.20@17.25c., as an average for the week.

Under the influence of bear operations, the standard market declined from £75 17s. 6d. for spot and £76 15s. for three months on Dec. 5, to £75 5s. spot and £76

1s. 3d. three months on Dec. 6. A better feeling, however, prevailed on the 9th, 10th and 11th, and there was some short covering by the bears as well as some purchases for bull account, as a result of which the market in general ruled about 10s. higher and closes at £75 10s. for spot and £76 10s. for three months.

Copper sheets are 23@24c. per lb., base for large lots; full extras are charged and higher prices for large quantities. Copper wire is 19@19¼c. base, carload lots at mill.

Copper exports from New York for the week were 6036 long tons. Our special correspondent gives the exports from Baltimore at 1433 tons for the week.

Tin—At the lower prices ruling in the London market during the latter part of last week, a fair business developed with Americans consumers. This found its reflection in a strong and advancing market on Dec. 9, although transactions were small. At the higher level business fell off considerably, and again a lower market was the consequence thereof. The market closes easy at £225 for spot and the same for three months, and about 49¼c. for December tin here.

Exports of tin from the Straits, 11 months ended Nov. 30, were 49,182 long tons in 1911, and 53,829 in 1912; an increase this year of 4647 tons.

Lead—At the close of last week, following the cut to 4.35c. by the A. S. & R. Co., the independent producers were for a while uncertain what to do. This week they made up their minds and began cutting the price again. This is the natural consequence of a good deal of lead being pressed for sale. There has been a somewhat better demand for lead at the lower prices, which, however, has been freely met. At the close lead is quoted 4.15@4.17½c., St. Louis; 4.30@4.35c., New York.

The London market is unchanged, Spanish lead being quoted £18 1s. 3d.; English lead 7s. 6d. higher.

The A. S. & R. Co. does not now issue a schedule of prices for lead at various places, but its present terms on contract shipments from smelter in 50-tons are said to be approximately as follows:

Place	Desilverized	Corroding
Philadelphia	4.40	4.50
Chicago	4.30	4.40
New York	4.35	4.45
Cincinnati	4.35	4.45
Boston	4.40	4.50
Pittsburgh	4.40	4.50
Buffalo	4.40	4.50
Baltimore	4.40	4.50
Syracuse	4.40	4.50
Rochester	4.40	4.50
Utica	4.40	4.50
Providence	4.40	4.50
Detroit	4.37½	4.47½
Cleveland	4.37½	4.47½
St. Louis	4.27½	4.37½

The average price of lead for the week ended Dec. 11 was 4.3375c., New York.

Spelter—A considerable tonnage of January spelter was sold at 7.10c., St. Louis, in the early part of the week. Since then spelter has been offered liberally at that price without finding buyers. Transactions in foreign spelter have again made New York a basing point and destroyed the usual differential between New York and St. Louis. Consumption, both in the galvanizing and brass trade continues excellent, but buyers are pretty well covered for the moment. At the close St. Louis is quoted 7.05@7.10c., and New York at 7.10@7.20 cents.

The European market is unchanged, good ordinaries being quoted £26 10s.; specials 15s. higher.

Base price of zinc sheets is $9 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7½@7⅝c. per lb., New York.

On Jan. 1, 1913, the National Zinc Co. will take over all the works of the United Zinc & Chemical Co. under a long lease.

Other Metals

Aluminum—The market is still rather quiet, and there seems to be no scarcity of metal at present. Quotations remain about the same, at 25½@26c. per lb. for No. 1 ingots, New York.

A report was recently noted that the Aluminum Co. of America had been buying up surplus stocks of metal abroad. The truth of this report is officially denied, and it is stated that the company has been making no efforts to control supply or prices.

A memorial has been filed with the Ways and Means Committee of the House of Representatives urging that the duty on aluminum be abolished and free imports permitted.

Antimony—The market is dull and prices are inclined to be weak. Cookson's is quoted at 10.15@10.50c. per lb. and Hallett's at 9.45@9.75c. Outside brands are unchanged at 9.12½@9.37½c. per lb. being asked for Hungarian and Chinese.

Quicksilver—The market is quiet and prices are easier. New York quotations are rather nominal at $41 per flask of 75 lb., with 58@59c. per lb. asked for small lots. San Francisco is $40.50 for domestic orders and $38 for export. The London price has been reduced 5s. and is £7 7s. 6d. per flask, with £7 5s. asked from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Cadmium—The latest quotation from Germany is 725@750 marks per 100 kg., f.o.b. works in Silesia. This is equal to 78.27@80.97c. per lb. at works.

Nickel—Shot, blocks and plaquettes bring 40@45c. per lb., according to quality. Electrolytic nickel is 3c. per lb. higher.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Selenium—Producers of this metal quote large lots at $2.75@3.50 per lb., according to size of order; while as high as $4.50@5.50 is paid for retail lots.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, 10 months ended Oct. 31, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess	
Copper, long tons	109,062	47,696	Imp.	61,366
Copper, 1911	120,763	62,819	Imp.	57,944
Tin, long tons	35,191	36,934	Exp.	1,743
Tin, 1911	38,040	38,617	Exp.	577
Lead, long tons	173,111	48,299	Imp.	124,812
Lead, 1911	180,743	55,105	Imp.	125,638
Spelter, l'g tons	119,161	8,646	Imp.	110,515
Spelter, 1911	110,365	8,062	Imp.	102,303
Quicksilver, lb.	3,499,691	2,060,088	Imp.	1,439,603
Quicksilver, '11	3,369,757	2,061,779	Imp.	1,307,978
Minor met's, tons	6,382	22,874	Exp.	16,492
Minor, 1911	4,938	18,634	Exp.	13,696
Ores				
Tin ore and con.	21,540	.....	Imp.	21,540
Tin ore, 1911	24,849	.....	Imp.	24,849
Pyrites	729,727	.....	Imp.	729,727
Pyrites, 1911	731,925	.....	Imp.	731,925

Copper totals include metallic contents of ore and matte. Exports include re-exports of foreign material. Minor metals include nickel, aluminum and the minor metals and alloys.

Spanish Metal Exports

Exports of metals and minerals from Spain, eight months ended Aug. 31, reported by *Revista Minera*, in metric tons:

Metals	1911	1912	Changes	
Pig and manuf. iron	30,845	28,430	D.	2,415
Copper	10,747	15,867	I.	5,120
Copper precipitate	9,878	9,848	D.	30
Lead	111,885	122,379	I.	10,494
Zinc	1,461	1,835	I.	374
Quicksilver	1,480	1,478	D.	2
Minerals				
Iron ore	5,211,711	5,647,999	I.	436,288
Manganese ore	23,825	22,679	D.	1,146
Copper ore	218,699	102,610	D.	116,089
Lead ore	1,964	2,457	I.	493
Zinc ore	94,699	79,875	D.	14,824
Pyrites	1,783,604	1,924,068	I.	140,464
Salt	388,402	428,861	I.	40,459

Pyritic ores are not classed as copper ores unless they carry 2.5% or over in copper; below that they are classed as pyrites. Last year the dividing line was 1% copper.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 7—The high price paid for zinc sulphide was $61, the base per ton of 60% zinc ranging from $54 to $58. Zinc silicate sold at $30@33 per ton of 40% zinc. The average price, all grades of zinc, is $52.54. Further decline in the lead market leaves $53 the base price per ton of 80% lead. The average price, owing to a bulk of the ore being purchased ahead, shows $53.54 per ton.

SHIPMENTS WEEK ENDED DEC. 7

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,163,250	.....	828,960	$137,455
Joplin	2,692,250	.....	315,620	83,750
Galena	1,205,450	.....	48,020	34,422
Duenweg	838,640	.....	61,840	24,669
Miami	720,450	.....	225,850	23,275
Alba-Neck	607,590	.....	.....	17,315
Granby	77,730	710,570	12,430	14,695
Oronogo	374,010	.....	249,420	14,628
Spurgeon	337,500	185,980	45,820	11,434
Jackson	395,380	.....	.....	10,872
Cave Springs	262,950	.....	6,810	7,544
Carl Junction	260,890	.....	.....	6,827
Lawton	192,320	.....	.....	5,385
Aurora	64,710	141,610	.....	4,013
Carthage	145,840	.....	.....	3,936
Wentworth	.....	67,900	.....	1,138
Totals	12,338,960	1,106,060	1,793,970	$401,358
49 weeks	539,066,150	34,208,210	87,852,260	$17,516,784

Blende val., the week, $334,630; 49 weeks, $14,470,705
Calamine, the week, 18,679; 49 weeks, 545,002
Lead value, the week, 48,049; 49 weeks, 2,501,077

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	51.56	38.45	49.25	54.57	54.64
April	38.88	52.00	37.47	50.36	56.37	54.18
May	38.25	55.30	36.79	53.27	55.21	52.45
June	40.50	55.88	38.18	54.38	56.49	55.01
July	40.75	58.85	38.36	56.59	58.81	58.83
August	42.50	55.13	41.28	53.27	60.74	57.04
September	42.63	59.75	41.29	57.07	59.33	61.26
October	42.38	57.00	40.89	55.97	54.72	63.22
November	45.40	55.69	43.25	53.98	57.19	56.55
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Dec. 11—The general markets continue active and rather strong.

Arsenic—Trade has been rather dull and prices are unchanged. The quotations are $4.87½ per 100 lb. for both spot and futures.

Copper Sulphate—Trade is fair and prices are unchanged at $5.50 per 100 lb. for carload lots, and $5.75 per 100 lb. for smaller parcels.

Nitrate of Soda—Trade is a little better, though inclined to be spasmodic. Quotations remain at 2.60c. per lb. for spot and futures up to Apr. 30. Futures are 2.57½c. for May, 2.55c. for June and 2.52½c. for July and later deliveries.

Petroleum

The monthly report of the *Oil City Derrick* shows new wells completed in November as follows: Pennsylvania, New York and West Virginia, 483; Lima-Indiana, 73; Kentucky, 16; Illinois, 139; Kansas-Oklahoma, 799; Texas-Louisiana, 138. In all the divisions 1653 wells were completed, having a new production of 58,836 bbl. Of the new wells 267 were failures and 170 gas wells. The number of oil-producing wells was 1216, as against 1190 in October. The new work under way at the close of the month showed 567 rigs and 1566 drilling wells, an increase of 48 rigs and a decrease of 78 drilling wells. The principal increase in new work is found in the Texas-Louisiana fields.

Dec. 3 advances were reported in Standard buying rates of 5c. per bbl. on Pennsylvania grade oils and 3c. per bbl. on Lima and Indiana grades.

Production of oil in California in October is reported at 8,158,814 bbl.; deliveries, 7,772,016 bbl.; stocks at end of month, 46,304,666 bbl. During October 67 wells were completed with a total production of 5650 bbl. daily.

Mining Stocks

New York, Dec. 11—Dec. 5 the Exchange was dull and weak, chiefly because of high money rates. On the Curb coppers were in some demand, but other mining stocks were neglected.

Dec. 6 there was a rally on the Exchange, but dealings were moderate and chiefly professional. The Curb was rather dull and mining stocks were weak.

Dec. 7 the Exchange was dull and irregular. Curb trading was also light, with small changes.

Dec. 9 there was heavy trading on the Exchange, but generally at receding prices and the close was weak. Mining stocks on the Curb were active, but nearly all lost in price, especially the copper shares.

Dec. 10 and 11 the heavy selling was met by an unexpected amount of buying on the Exchange. Prices were confused, rallying and then breaking again. On the Curb trading in mining stocks was good, but the movement of quotations was irregular.

Boston, Dec. 10—Copper shares, in common with others, show sharp declines in comparison with the prices of a week ago. Outright liquidation has followed and present market conditions are rather chaotic, to say the least. The present depression in the price of copper shares is purely technical and is due to the strained money conditions and uncertainty regarding the future.

Nine mining stocks sold at the lowest of the year today, while many others, including Osceola, equaled the low level of the year. Adventure made a low record of $5, Algonah $2.50, Allouez $35, Copper Range $48.50, Lake $24, Ojibway $2, with the $1 assessment paid, Superior & Boston $1.12½, Wolverine $69.50 and Wyandot $1.

In the slump today Amalgamated broke to $75.50. Butte & Superior broke $9.50 to $37.25, Calumet & Arizona $13.12½ to $66.75, Calumet & Hecla $43 to $515, Granby $11.75 to $62, Mohawk $6 to $58, North Butte $6.75 to $30 and U. S. Smelting common $5 to $40 per share.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	Sept.	October	Sept.
Alaska shipments	1,726,715	1,435,235	.....
Anaconda	24,500,000	25,250,000	24,250,000
Arizona, Ltd	3,340,000	3,200,000	3,000,000
Copper Queen	9,103,861	8,184,575	8,807,940
Calumet & Ariz	4,462,000	4,404,000	4,918,000
Chino	3,217,369	3,638,500	3,911,169
Detroit	1,881,668	1,934,828	1,968,620
East Butte	1,250,000	.....	.....
Mammoth	1,834,937	1,883,283	.....
Giroux	1,005,208	.....	.....
Mason Valley	1,200,000	1,563,700	.....
Nevada Con	5,607,578	850,741	.....
Ohio	635,000	.....	.....
Old Dominion	2,204,000	2,523,000	2,758,000
Ray	2,978,404	.....	3,201,500
Shannon	1,142,000	1,210,000	1,436,000
South Utah	225,568	.....	.....
United Verde*	2,750,000	2,750,000	.....
Utah Copper Co	6,616,887	2,022,352	.....
Lake Superior*	19,250,000	21,500,000	20,400,000
Non-rep. mines*	8,094,792	8,250,000	8,250,000
Total production	103,025,987	.....	.....
Imports, bars, etc.	25,149,329	.....	.....
Total blister	128,175,316	.....	.....
Imp. in ore & matte	7,142,232	.....	.....
Total American	135,317,548	.....	.....
Miami†	2,949,150	2,577,750	2,972,000
Brit. Col. Cos.:			
British Col. Copper	.....	1,022,904	.....
Granby	2,083,118	2,018,424	.....
Mexican Cos.:			
Boleo†	.....	2,612,400	.....
Cananea	3,500,000	4,248,000	5,064,000
Moctezuma	771,844	3,045,667	2,112,377
Other Foreign:			
Cape Cop., S. Africa	678,720	757,120	.....
Kyshtim, Russia	1,750,000	.....	.....
Spassky, Russia	981,120	974,400	.....
Tilt Cove, Newf'd	.....	86,785	.....
Exports from:			
Chile	6,048,000	8,512,000	.....
Australia	7,616,000	9,520,000	.....
Arrivals in Europe‡	8,518,720	13,771,520	.....

†Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

‡Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

Month	U.S. Refin'y Product'n	Deliveries, Domestic	Deliveries for Export
XI, 1911	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566
IV	125,464,644	69,513,846	53,252,326
V	126,737,836	72,702,277	69,485,945
VI	122,315,240	66,146,229	61,449,650
VII	137,161,129	71,094,381	60,121,331
VIII	145,628,521	78,722,418	70,485,150
IX	140,089,819	63,460,810	60,264,796
X	145,405,453	84,104,734	47,621,342
XI	134,695,400	69,369,795	55,906,550

VISIBLE STOCKS

	United States	Europe	Total
XII, 1911	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,387
IV	62,367,557	136,819,200	199,186,757
V	65,066,029	134,176,000	199,242,029
VI	49,615,643	117,801,600	167,417,243
VII	44,335,004	108,186,000	152,521,004
VIII	50,280,421	113,299,200	163,579,621
IX	46,701,374	113,568,000	160,269,374
X	63,065,587	107,408,000	170,473,587
XI	76,744,964	103,801,600	180,546,564
XII	86,164,059	96,947,200	183,111,259

Curb trading has been of fair volume. The feature was a sharp break in Butte Central shares from $9.43¾ to $4.75, with recovery to $6.37½. The calling of loans enforced selling of the stock. Mexican Metal receipts were exchanged into stock today and the stock is active at $1.50 and just under.

Assessments

Company	Delinq	Sale	Amt.
Bonnie Brier, Utah	Nov. 30	Dec. 20	$0.001
Brunswicd-Potosi, Nev	Nov. 27	Dec. 19	0.01½
Butte & Anaconda, Mont	Jan. 1	Feb. 1	0.0½
Challenge Con., Nev	Dec. 4	Dec. 27	0.05
Consolidated Virginia, Nev.	Nov. 26	Dec. 20	0.15
East Crown Point, Utah		Dec. 30	0.0½
East Hercules Ext., Ida	Dec. 15	Jan. 3	0.001½
Echo, Ida	Dec. 11	Jan. 8	0.001
Hider Nevada, Utah	Dec. 20	Jan. 11	0.0½
Honolulu, Ida	Nov. 20	Dec. 21	0.001½
Hypotheek, Ida	Dec. 18	Jan. 10	0.005
Jack Waite, Ida	Nov. 30	Dec. 21	0.01
Leroy Gold & Copper, Ida	Nov. 28	Dec. 28	0.002
Little North Fork, Ida	Nov. 16	Dec. 16	0.001
Mayflower, Ida	Nov. 27	Dec. 27	0.005
Moon Creek, Ida	Dec. 4	Jan. 4	0.002
Nabob, Ida	Dec. 2	Dec. 23	0.005
North Star, Ida	Nov. 30	Dec. 30	0.001
N. Y. Bonanza, Utah	Dec. 7	Dec. 28	0.02
Ojibway, Mich	Dec. 9	Dec. 10	1.00
Overman, Nev	Dec. 5	Dec. 24	0.05
Scorpion, Nev	Nov. 27	Dec. 18	0.01
Seven Troughs Mon., Utah	Dec. 15	Jan. 6	0.0½
Sierra Nevada, Nev	Dec. 2	Dec. 23	0.10
Signet, Utah		Dec. 15	0.005
Superior & Boston, Mont	Jan. 4		1.00

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	59.207	24.483	24.595	27.284
May	53.870	53.308	60.880	24.797	24.583	28.038
June	53.462	53.043	61.290	24.651	24.486	28.215
July	54.150	52.630	60.654	25.034	24.286	27.919
August	52.912	52.171	61.606	24.428	24.082	28.375
September	53.295	52.440	63.078	24.567	24.209	29.088
October	55.490	53.340	63.471	25.596	24.594	29.299
November	55.635	55.719	62.792	25.680	25.649	29.012
December	54.428	54.905		25.160	25.349	
Year	53.486	53.304		24.670	24.592	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	15.741	12.275	15.930	54.034	70.294
May	11.989	16.031	12.214	16.245	54.313	72.352
June	12.385	17.234	12.611	17.443	56.365	78.259
July	12.463	17.190	12.720	17.353	56.673	76.636
August	12.405	17.498	12.634	17.644	56.266	78.670
September	12.201	17.508	12.508	17.698	55.253	78.762
October	12.189	17.314	12.370	17.661	55.170	76.389
November	12.616	17.326	12.769	17.617	57.253	76.890
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	44.519
February	41.614	42.962	August	43.319	45.857
March	40.157	42.577	September	39.755	49.135
April	42.185	43.923	October	41.185	50.077
May	43.115	46.053	November	43.125	49.891
June	44.606	45.815	December	44.655	
			Av. Year	42.281	

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.597
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	4.200	4.262	4.118	12.889	16.331
May	4.373	4.194	4.223	4.072	12.984	16.509
June	4.435	4.392	4.292	4.321	13.260	17.588
July	4.499	4.720	4.397	4.603	13.530	18.544
August	4.500	4.569	4.406	4.452	14.260	19.655
September	4.485	5.048	4.356	4.924	14.744	22.292
October	4.265	5.071	4.139	4.894	15.332	20.630
November	4.298	4.615	4.181	4.463	15.821	18.193
December	4.450		4.332		15.648	
Year	4.420		4.286		13.970	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	6.633	5.249	6.483	23.743	25.644
May	5.348	6.679	5.198	6.529	24.375	25.790
June	5.520	6.877	5.370	6.727	24.612	25.763
July	5.695	7.116	5.545	6.966	25.006	26.174
August	5.953	7.028	5.803	6.878	26.801	26.443
September	5.869	7.454	5.719	7.313	27.750	27.048
October	6.102	7.426	5.951	7.276	27.256	27.543
November	6.380	7.371	6.223	7.221	26.795	26.804
December	6.301		6.151		26.849	
Year	5.758		5.608		25.281	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	15.13	14.65	13.90	15.00	14.15
May	15.90	15.14	14.30	13.90	14.72	14.12
June	15.90	15.15	14.06	14.11	14.56	14.22
July	15.90	15.15	14.03	14.38	14.53	14.38
August	15.90	15.43	14.00	14.90	14.47	14.85
September	15.90	16.86	13.57	16.03	14.40	15.63
October	15.43	17.90	13.44	17.18	14.34	17.22
November	14.92	18.07	13.30	17.09	14.25	18.00
December	15.15		13.10		13.90	
Year	$15.72		$13.94		$14.49	

STOCK QUOTATIONS

COLO. SPRINGS Dec. 10

Name of Comp.	Bid.
Acacia	.04⅜
Cripple Cr'k Con.	.01⅞
C. K. & N.	.16
Doctor Jack Pot	.06
Elkton Con.	.63½
El Paso	5.50
Findlay	.03¾
Gold Dollar	.18
Gold Sovereign	.02½
Isabella	.18½
Jack Pot	.05⅜
Jennie Sample	‡.06
Lexington	.006
Moon Anchor	.01
Old Gold	.03⅜
Mary McKinney	.74½
Pharmacist	.01½
Portland	1.05
Vindicator	.88
Work	‡.01

SALT LAKE Dec. 10

Name of Comp.	Bid.
Beck Tunnel	.09
Black Jack	.11
Cedar Talisman	.01
Colorado Mining	.21
Columbus Con	.10
Crown Point	.04
Daly-Judge	‡6.15
Grand Central	.80
Iron Blossom	1.30
Little Bell	‡.25
Lower Mammoth	.05
Mason Valley	8.00
May Day	.22½
Nevada Hills	1.30
New York	‡.00½
Prince Con	1.65
Silver King Coal'n	3.50½
Sioux Con	.02
Uncle Sam	.12
Yankee	.12¾

TORONTO Dec. 10

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.45	Foley O'Brien	.25
T. & Hudson Bay	‡60.00	Hollinger	15.10
Temiskaming	.42¾	Imperial	.03
Wettlaufer-Lor	.25	Pearl Lake	.20½
Am. Goldfield	‡.40	Porcu. Gold	.18½
Apex	.00½	Preston E. D.	.03
Crown Chartered	.02½	Rea	.25
Dobie	‡.25	Standard	‡.00½
Dome	19.00	Swastika	.09½
Dome Exten	.09	West Dome	‡.13

SAN FRANCISCO Dec. 10

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.05	Belmont	8.02½
Belcher	.20	Jim Butler	.57
Best & Belcher	.05	MacNamara	.17
Caledonia	.76	Midway	.26
Challenge Con	.03	Mont.-Tonopah	1.67½
Chollar	.02	North Star	.17
Confidence	.30	West End Con	1.12½
Con. Virginia	.30	Atlanta	.13
Crown Point	.30	Booth	.05
Gould & Curry	.01	C.O.D. Con	.07
Hale & Norcross	.09	Comb. Frac	.07
Mexican	‡1.80	Jumbo Extension	.21
Occidental	.70	Pitts.-Silver Peak	.64
Ophir	.30	Silver Pick	.05
Overman	‡.50	St. Ives	.30
Potosi	.02	Tramp Con	‡.02
Savage	.07	Argonaut	‡2.00
Sierra Nevada	.30	Bunker Hill	‡4.50
Union Con	.21	Central Eureka	.39
Yellow Jacket	.34	So. Eureka	‡1.50

N. Y. EXCH. Dec. 10

Name of Comp.	Clg.
Amalgamated	76⅜
Am. Agri. Chem	54¼
Am.Sm.&Ref.,com	69⅜
Am. Sm. & Ref., pf.	104
Am. Sm. Sec., pf. B	84
Anaconda	39
Batopilas Min	1¼
BethlehemSteelpf	63⅞
Chino	41½
Federal M. & S., pf.	38½
Goldfield Con	1⅝
GreatNor.,ore,,ctf.	41½
Guggen. Exp	50⅞
Homestake	103
Inspiration Con	17¾
Miami Copper	25⅝
Nat'nalLead,com.	55¼
National Lead, pf.	104
Nev. Consol	19½
Phelps Dodge	215½
Pittsburg Coal, pf.	86
Ray Con	19¾
RepublicI&S,com.	24⅞
Republic I & S, pf.	86
SlossSheffi'd,com.	45
Sloss Sheffield, pf.	97
Tennessee Copper	36¾
Utah Copper	58
U. S. Steel, com	65¾
U. S. Steel, pf.	108
Va. Car. Chem.	42½

N. Y. CURB Dec. 10

Name of Comp.	Clg.
Barnes King	‡.60
Beaver Con	.41
Braden Copper	9⅝
B. C. Copper	4
Buffalo Mines	2½
Caledonia	.40
Con. Ariz. Sm	1⅛
Davis-Daly	1¾
Diam'field-Daisy	‡4
Ely Con	.10
Florence	.62
Giroux	3 5/16
Gold Hill Con	5/16
Greene Cananea	8⅜
Greenwater	.04
Internat. S. & R.	‡124
Kerr Lake	2½
Keystone	2
La Rose	2 7/16
McKinley-Dar-Sa	2¼
Min. Co. of A. new	27⅛
Motherlode Gold	‡.60
Nev. Utah M. & S.	.04
Nipissing Mines	8¼
Ohio Copper	1¼
Pacific Sm. & M	1/16
Puebla S. & R.	2 3/16
South Live Oak	2
South Utah M. & S.	‡⅛
Standard Oil (Old)	1110
Stand'd Oil of N.J.	382
Stewart	1¼
Tonopah	6⅜
Tonopah Ex	2⅜
Tonopah Merger	⅜
Tri-Bullion	1/16
Tularosa	1½
Union Mines	‡⅜
United Cop., pfd.	10
Yukon Gold	3

LONDON Dec. 11

Name of Com.	Clg.
Camp Bird	£1 18 9d
Dolores	‡1 10 0
El Oro	0 17 3
Esperanza	2 0 0
Mexico Mines	7 7 6
Oroville	0 6 6
Stratton'sInd.	‡0 3 1½
Tomboy	1 8 3

BOSTON EXCH. Dec. 10

Name of Comp.	Clg.
Adventure	5
Ahmeek	330
Algomah	2⅝
Allouez	36
Am. Zinc	27
Ariz. Com., ctfs.	3
Bonanza	‡.30
Boston & Corbin	4¾
Butte & Balak	3¾
Calumet & Ariz	67⅞
Calumet & Hecla	520
Centennial	18¼
Cliff	13
Copper Range	49¼
Daly West	4
East Butte	14
Franklin	8¾
Granby	63
Hancock	23
Hedley Gold	23
Helvetia	70
Indiana	14
Island Cr'k, com.	52½
Island Cr'k, pfd.	85½
Isle Royale	29¼
Keweenaw	2
Lake	24
La Salle	5
Mass	5
Michigan	2
Mohawk	58½
New Arcadian	2¼
New Idria Quick	7
North Butte	31
North Lake	3
Ojibway	2¼
Old Dominion	52⅛
Osceola	102
Quincy	75
Shannon	12⅜
Shattuck-Ariz	28¼
Superior	36
Superior & Bost.	1⅛
Tamarack	34½
Trinity	4¼
Tuolumne	2¾
U. S. Smelting	41¼
U. S. Smelt'g, pf.	49⅞
Utah Apex	1⅞
Utah Con	10¼
Victoria	2
Winona	3½
Wolverine	69
Wyandot	1

BOSTON CURB Dec. 10

Name of Comp.	Last
Alaska Gold M	9⅛
Bingham Mines	4⅜
Boston Ely	1⅛
Boswyocolo	.01
Butte Central	6½
Cactus	.07
Calaveras	2⅝
Chief Cons	1⅜
Corbin	.12
Cortez	.70
Crown Reserve	3½
First Nat. Cop	1⅜
Majestic	.41
Mazatan	‡½
Moneta Porc	‡.03
Nevada-Douglas	3½
New Baltic	1½
Oneco	1⅜
Raven Copper	.21
Portsmouth Coal	‡.05
San Antonio	‡3⅛
Smokey Dev	2⅜
S. W. Miami	4
South Lake	6
Trethewey	.33
United Verde Ext.	½

‡Last quotation.